RUSS OLSON VOLUME 29A

MINNESOTA NORTHWESTERN ELECTRIC RY

INDUSTRIAL ELECTRIC RAILWAYS

SOUTH ST PAUL RAPID TRANSIT CO

Description

Information regarding the above-named electrified industrial and streetcar companies.

Sub-divisions Within This Volume

- Minnesota Northwestern Electric Ry
- Industrial Electric Railways
    - Minneapolis Municipal Waterworks Ry
    - Central Warehouse Co
    - Several Iron Ore Mining Railways
- South St. Paul Rapid Transit Co. (Monorail)

MINNESOTA NORTHWESTERN ELECTRIC RAILWAY

MINNESOTA NORTHWESTERN ELECTRIC RAILWAY

Thief River Falls to Goodridge

This company was incorporated October 1, 1913, by Daniel Shaw, F. D. Brandenburg and H. W. Protzeller. The purpose was to build a line from the Soo Line division point at Thief River Falls to International Falls, 150 miles distant. The 1917 population figures were Thief River Falls 3,714 persons and International Falls 1,487 persons. Two proposed routes were considered. The most direct route traversed the swamps of Beltrami and Koochiching counties. The other route was more circuitous, following the Baudette River to the Rainy River and thence along the American side of the Rainy River joining the first proposed route south of Loman. A 1926 state auditor's land map showed a more specific version of the more direct route, connecting at Loman with the Minnesota, Dakota & Western Railway, instead of building its own line into International Falls.

Construction began in December, 1913, with the bridge over the Thief River in Thief River Falls. A grading contract was let April 3, 1914, to John Moberg of Bemidji who started work in May. Financial complications quickly arose and as the Soo Line was very much interested in this proposed connection advanced the money necessary to complete the first 18.56 miles of line, using 60 lb. and 72 lb. rail on a light grade through rolling woodland from Thief River Falls through Silverton and Mavie to Goodridge (1914 population 300 persons). Connection with the Soo Line was made in Thief River Falls and their depot used for the terminal. A carhouse-repair shop ~~were~~ was located southeast of the Soo Line roundhouse. Offices were located at the corner of 2nd and Labree Avenues.

A General Electric Co.-Wason Mfg. Co. gasoline-electric passenger-baggage motor car was purchased at a cost of $26,094. This car was built during July, 1914, serial number 3776, and supposedly first acquired by the Electric Short Line Railway. The car, numbered 101, arrrived August 6, 1914. A few days later a trial run was made from Thief River Falls to Silverton. Operation over the completed line to Goodridge began October 12, 1914.

Timetable Number 1 listed two passenger round trips and one freight trip. The passenger trips required one hour running time one way. The freight trip required one hour and 50 minutes eastbound and one hour and 25 minutes westbound. The freight trip would carry passengers as an accommodation. Passenger trips left Thief River Falls at 7:15 a.m. and 3:45 p.m.; Goodridge at 8:30 a.m. and 5:00 p.m. The freight trip left Thief River Falls at 9:45 a.m. and Goodridge at 1:45 p.m. One way passenger fare was 50 cents. Daily express service was offered by the Western Express Company.

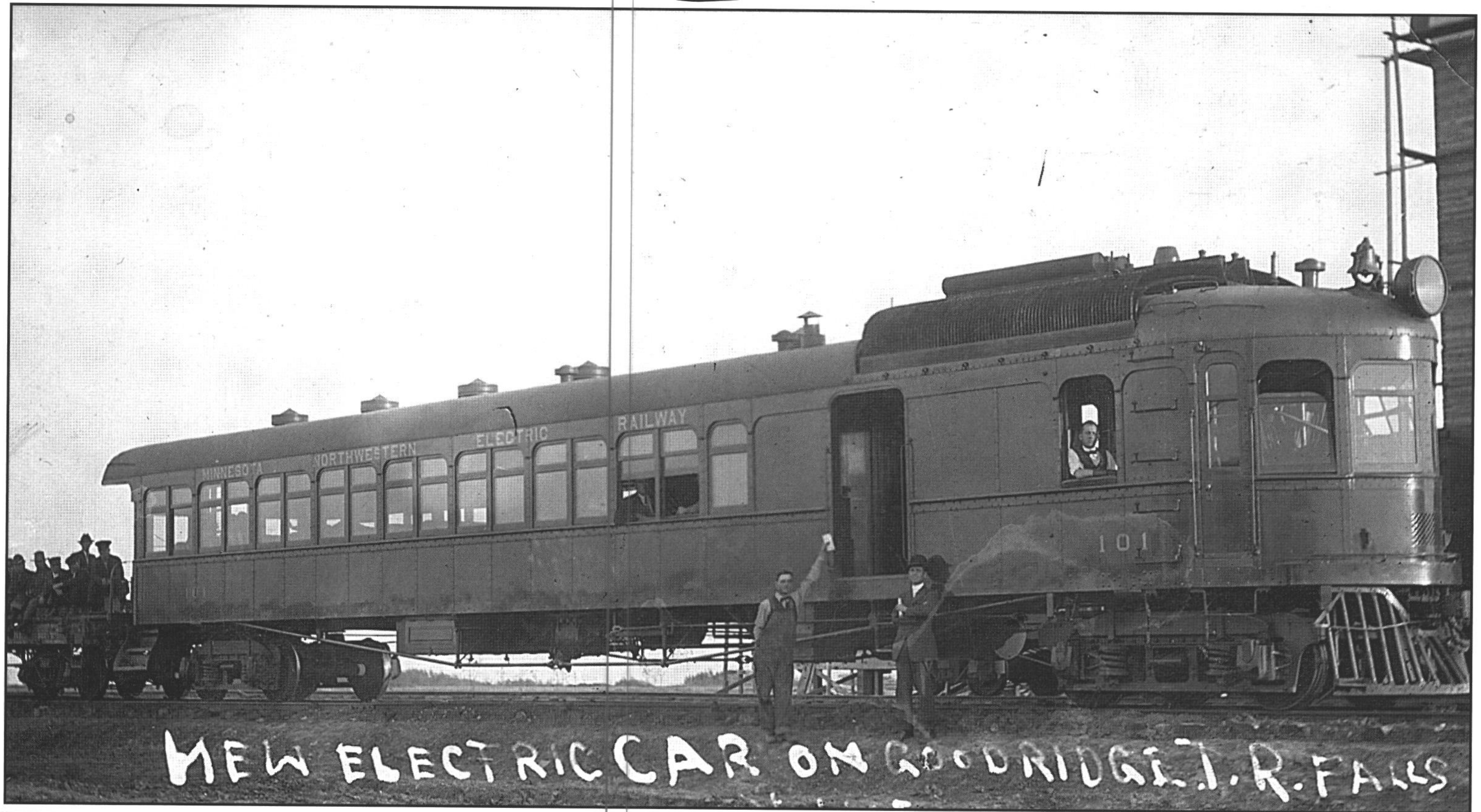
According to Minnesota Railroad & Warehouse Commission records the cost of construction was $168,362.61. The Soo Line acquired title to the property on February 9, 1915, in exchange for the funds advanced for construction, which according to the Soo Line amounted to $177,892.61. The property was leased back to the Minnesota Northwestern Electric Ry. as of that same date. Officers of the company were Daniel Shaw, president and treasurer; D. N. Winton, vice-president; and H. W. Protzeller, secretary, general manager and purchasing agent. The projected extension was never undertaken. The swamp lands that dominate the route are largely uninhabited to this day.

As of December 31, 1919, the first main track was 18.67 miles, sidings 1.46 miles, and total track 20.13 miles. Equipment consisted of the one gasoline-electric passenger-baggage motor car and four miscellaneous trailers.

The passenger-baggage motor car pulled the occasional freight cars necessary to service the little freight traffic generated by the dairy and farming country through which the line ran. Grain elevators were located at Silverton and Mavie. Businesses at Goodridge consisted of a grain elevator, stockyard, and a large freight warehouse. One photograph showed the gas-electric car pulling eight box cars.

The 1931 timetable indicated that two daily-except-Sunday round trips were operated. This was later reduced to one round trip. Trucks and automobiles offered increasing competition. In 1938 the operating ratio was 217% with a net operating deficit of $10,243. The Soo Line was bankrupt. Abandonment came March 15, 1940. Gas-electric car number 101 was sold for scrap December 5, 1940, to the Iron and Steel Products Co., Chicago.

ALL TRAINS RUN DAILY—EXCEPT SUNDAY.						
EAST BOUND (Read Down)				WEST BOUND (Read Up)		
Train No. 3	Train No. 1	Miles	STATIONS	Miles	Train No. 2	Train No. 4
3:30 p. m.	7:30 a. m.	0.0	THIEF RIVER FALLS	18.3	9:40 a. m.	5:45 p. m.
3:40	7:43	4.2	STOP No. 4	14.1	9:25	5:20
3:42	7:46	5.1	STOP No. 5	13.2	9:22	5:18
3:45	7:50	6.1	SILVERTON	12.2	9:20	5:15
3:47	7:53	7.1	STOP No. 6	11.2	9:17	5:12
3:49	7:56	8.1	STOP No. 7	10.2	9:15	5:09
3:51	7:59	9.1	STOP No. 8	9.2	9:12	5:07
3:54	8:02	10.1	STOP No. 9	8.2	9:10	5:04
3:57	8:05	11.1	STOP No. 10	7.2	9:07	5:02
4:00	8:10	12.1	MAVIE	6.2	9:05	5:00
4:02	8:12	13.1	STOP No. 11	5.2	9:02	4:55
4:04	8:15	14.1	STOP No. 12	4.2	9:00	4:52
4:07	8:17	15.1	STOP No. 13	3.2	8:57	4:49
4:09	8:20	16.1	STOP No. 14	2.2	8:55	4:46
4:11	8:22	17.1	STOP No. 15	1.2	8:52	4:43
4:20	8:30	18.3	GOODRIDGE	0.0	8:50	4:40


MINNESOTA NORTHWESTERN ELECTRIC RAILWAY
101
NEW ELECTRIC CAR ON GOODRIDGE T. R. FALLS

MINNESOTA NORTHWESTERN ELECTRIC RAILWAY COMPANY

12-31-1917

DIRECTORS

Name	Postoffice Addres	Date of Expiration of Term
Daniel Shaw	Thief River Falls, Minn	September 25, 1918
H. W. Protzeller	Thief River Falls, Minn	
D. N. Winton	Minneapolis, Minn	

GENERAL OFFICERS

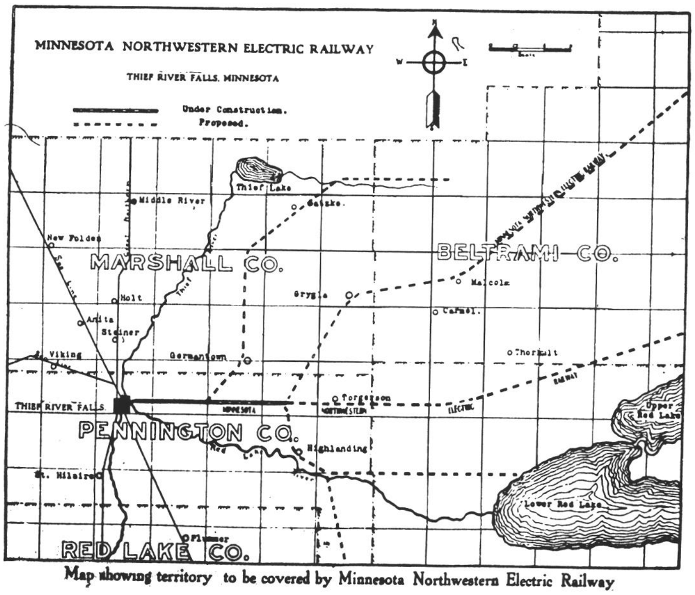
Title	Name	Postoffice Address
President	Daniel Shaw	Thief River Falls, Minn.
First Vice President	D. N. Winton	Minneapolis, Minn.
Secretary	H. W. Protzeller	Thief River Falls, Minn.
Treasurer	Daniel Shaw	Thief River Falls, Minn.
General Counsel	Stanton & Rowberg	Thief River Falls, Minn.
General Auditor	E. M. Schutt	Thief River Falls, Minn.
General Manager	H. W. Protzeller	Thief River Falls, Minn.
Mechanical Superintendent	W. R. Patterson	Thief River Falls, Minn.

Name of Officer in charge of correspondence with the Commission regarding this report, H. W. Protzeller, Secretary and General Manager, Thief River Falls, Minn.

THIEF RIVER FALLS. 3,714.

514 — Minnesota Northwestern Elec. Ry. Co.—Office, Cor. Second & Labree Aves., Thief River Falls. (Operates from Thief River Falls through Silverton and Mavie to Goodridge.)

Pres. & Treas.
Daniel Shaw ....Thief River Falls
V. Pres. D. N. Winton,
954 Security Bldg., Minneapolis, Minn.
Sec., Gen. Mgr. & Pur. Agt.
H. W. Protzeller......Thief River Falls
Audr. E. M. Schutt...... " "
Supt. of Mot. Pwr.
W. R. Patterson .... " "
Repair shops at Thief River Falls.
19.87 miles: 4-8½ g; 1 gas-elec. car.
(Does freight business.) 5-1920 59


MINNESOTA NORTHWESTERN ELECTRIC RAILWAY
THIEF RIVER FALLS, MINNESOTA
Under Construction.
Proposed.
N
W
E
Thief Lake
Middle River
Gatzke.
New Folden
MARSHALL CO.
BELTRAMI CO.
Holt
Thief
Argyle
Grygla
Malcolm
Carmel.
Anita
Steiner
Viking
Germantown
Thorhult
Torgerson
THIEF RIVER FALLS
MINNESOTA
NORTHWESTERN
ELECTRIC
RAILWAY
PENNINGTON CO.
Upper Red Lake
Highlanding
Red Lake River
St. Hilaire
Lower Red Lake
Plummer
RED LAKE CO.

Map showing territory to be covered by Minnesota Northwestern Electric Railway

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"LAY A NICKEL ON THE TRACK AND WE WILL PICK IT UP"

Our service is maintained just from that standpoint. We operate our trains for the convenience of our patrons. Stop us anywhere and we will accomodate you either for freight or passenger service.

Minnesota Northwestern Electric Railway Co.

MINNESOTA NORTHWESTERN ELECTRIC RAILWAY

Incorporated Under The Laws of The State of Minnesota.
Authorized Capitalization $500,000

Safe and Sure Investment
With
Assurance of Dividends

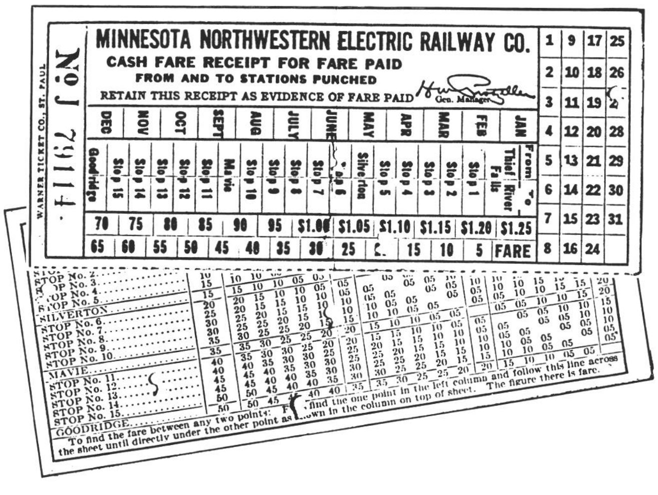
THE stock of this company is the investment opportunity you have been waiting for. It is sure to rise in value very rapidly because it will earn dividends from the start. The dividends and value of stock will increase with the development of the country. Many electric railways that cost four times as much to build and have a smaller territory and less business than this railway are paying their stockholders from 12 to 30 per cent annually. The average dividends of electric railways in the United States are more than 6 per cent. This stock will pay as much as the best. Can you afford to miss this opportunity.

Seven per cent preferred Participating Stock, $100 per share. Units of 2 shares of seven per cent Preferred Participating and 1 share of seven per cent Common Participating, $250.

Payment of stock may be extended over a period of one year.

For Further Information Call on or Write to

Minnesota Northwestern Electric Railway Company
113 Second St. East, Thief River Falls, Minn.
NEXT DOOR TO POSTOFFICE. TELEPHONE NO. 134



WARNER TICKET CO., ST. PAUL

No J 79114

MINNESOTA NORTHWESTERN ELECTRIC RAILWAY CO.

CASH FARE RECEIPT FOR FARE PAID
FROM AND TO STATIONS PUNCHED
RETAIN THIS RECEIPT AS EVIDENCE OF FARE PAID

H W Protzeller
Gen. Manager

DEC NOV OCT SEPT AUG JULY JUNE MAY APR MAR FEB JAN

Goodridge, Stop 15, Stop 14, Stop 13, Stop 12, Stop 11, Mavie, Stop 10, Stop 9, Stop 8, Stop 7, Stop 6, Silverton, Stop 5, Stop 4, Stop 3, Stop 2, Stop 1, Thief River Falls, From To

70 75 80 85 90 95 $1.00 $1.05 $1.10 $1.15 $1.20 $1.25

65 60 55 50 45 40 35 30 25 20 15 10 5 FARE

1	9	17	25
2	10	18	26
3	11	19	27
4	12	20	28
5	13	21	29
6	14	22	30
7	15	23	31
8	16	24	

STOP No. 2
STOP No. 3
STOP No. 4
STOP No. 5
SILVERTON
STOP No. 6
STOP No. 7
STOP No. 8
STOP No. 9
STOP No. 10
MAVIE
STOP No. 11
STOP No. 12
STOP No. 13
STOP No. 14
STOP No. 15
GOODRIDGE

To find the fare between any two points: Find the one point in the left column and follow this line across the sheet until directly under the other point as shown in the column on top of sheet. The figure there is fare.

EXPLANATORY TEXT

5/30/16

MINNESOTA NORTHWESTERN ELECTRIC RAILWAY COMPANY

1. DESCRIPTION OF ROAD.

The Minnesota Northwestern Electric Railway Company owns no common carrier property but operates under lease a single track, standard gauge railroad extending from a connection with the Minneapolis, St.Paul & Sault Ste. Marie Railway at Thief River Falls to the end of the line at Goodridge, all in the State of Minnesota. The property operated is owned by the Minneapolis, St.Paul & Sault Ste. Marie Railway Company.

In addition to the property operated under lease this company has the right to the use of the depot and roundhouse owned by the Minneapolis, St.Paul & Sault Ste. Marie Railway Company at Thief River Falls.

2. MILEAGE AND VALUATION SECTIONS.

One valuation section has been established with mileage as follows:

Main Track	18.671
Yard Tracks and Sidings	1.452
All Tracks	20.123

3. CHARACTERISTICS OF COUNTRY.

This road passes through a region that is partly timbered and partly cleared and under cultivation. The topography is gently rolling and the soil is black loam and peat underlaid by sand and clay.

The principal products of this territory are those of the farm and the forest.

4. ROAD.

The grading is light, only common material being encountered. The principal bridge is across the Thief River and consists of four 37' I beam spans with pile trestle approaches.

The main track is laid with 72 and 60-lb. relay rails.

5. EQUIPMENT.

This company leases from the Minneapolis, St.Paul & Sault Ste. Marie Railway Company one gas electric motor car.

6. ENGINEERING AND GENERAL EXPENDITURES.

Engineering has been estimated at 4 per cent upon Road Accounts 3 to 47.

General Expenditures Accounts 71 to 77, exclusive of Account 76, have been estimated at 1-1/2 per cent upon Road Accounts 1 to 47, exclusive of Account 2 - Land.

Interest During Construction, Account 76, has been estimated at the rate of 6 per cent per annum for one-half the construction period plus 3 months upon Road Accounts 1 to 47, exclusive of Account 2-Land, and General Expenditures, Accounts 71 to 77, exclusive of Account 76, and for 3 months upon Equipment Accounts 51 to 58.

7. GENERAL INFORMATION.

(a) **Grading:** Grading has been computed on the two-way basis.

(b) **Shrinkage:** Ten per cent has been added to ballast quantities for shrinkage.

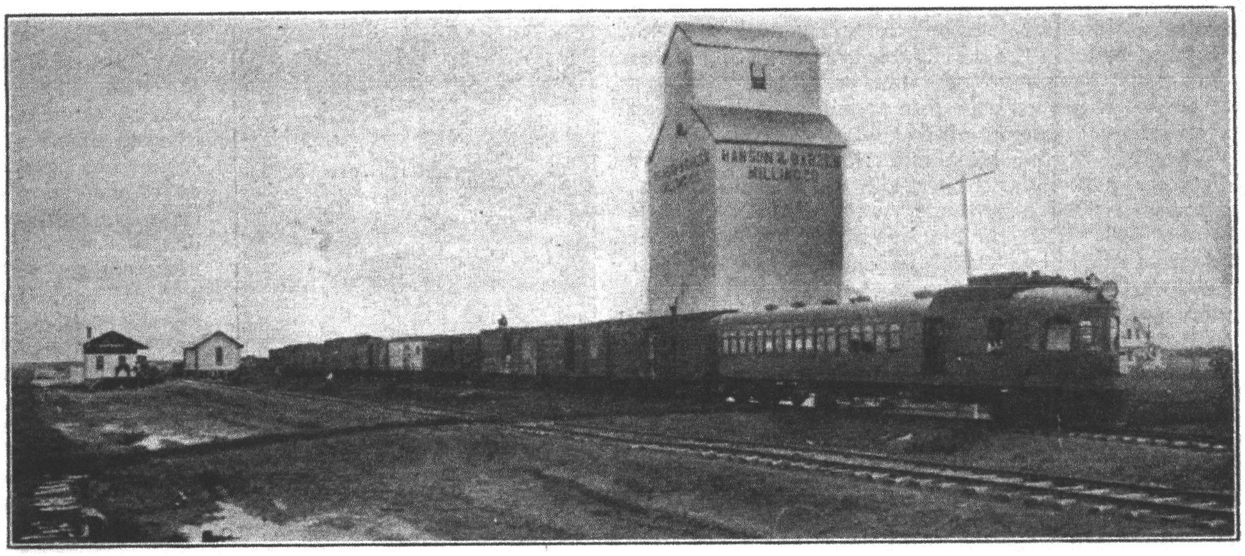
(c) **Waste:** The following percentages of actual quantities have been added for waste.

Spikes	3 per cent
Bolts	1 "
Angle bars	2 "

(d) **Salvage:** Salvage and scrap values are as follows:

Rail (scrap)	$11.00 per G.T.
Rail joints, track fastenings except spikes, and switch material (scrap)	0.50 " Cwt.
Bridge steel (scrap)	0.002 " Lb.

Revised page prepared by direction
of the Commission Dec. 20, 1928.



FREIGHT HAULAGE WITH A SELF-PROPELLED MOTOR CAR

Branch Line Operation with Self-Propelled Motor Cars

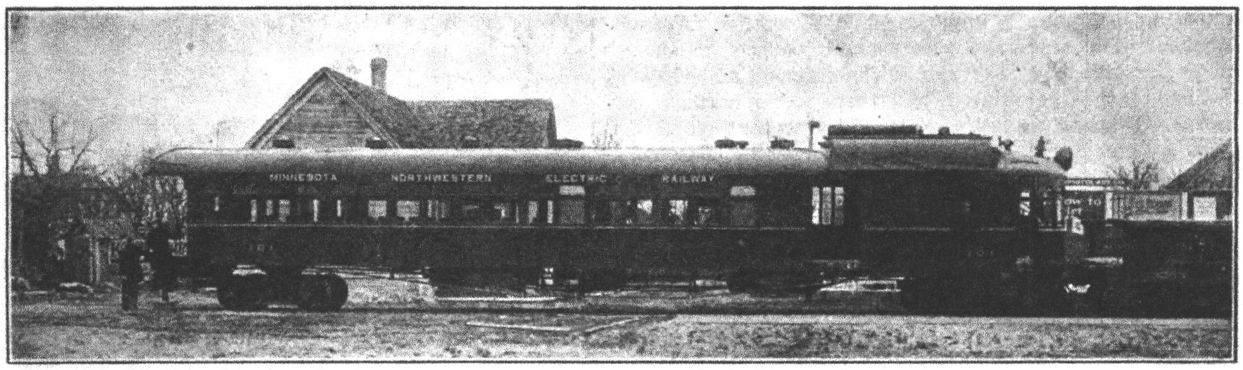
Results Obtained in Operating a Gasoline-Electric Car on the Minnesota Northwestern Railway for the Last Four Years Are Given, Together with an Account of the Service Rendered

By H. W. PROTZELLER
General Manager Minnesota Northwestern Electric Railway

THE economical operation of the large trunk lines of railroads in this country depends to a large extent upon making the branch lines or feeders self-supporting. These branch lines must be made to pay their operating expenses and fixed charges from their own gross revenue, thus relieving the main lines of their burden of support. A very large number of them are now being operated with the cast-off equipment of the main lines, and practically every one of them is daily piling up deficits. To reduce or wipe out these deficits, they should have more economical and efficient equipment.

The need for self-propelled motor cars as adjuncts to the regular equipments of steam railroads has been apparent for many years. These cars provide a clean, quick and attractive service and are capable of being operated by the minimum amount of labor. However, there has always been an impression in the minds of most railroad officials that the self-propelled motor car is a piece of equipment that has to "puff and snort" pretty hard in order to drag its own weight over the rails and that when any real work is to be done it is necessary to rely on steam equipment. Actual results show that the self-propelled car will handle all of the passenger, express and freight business that is usually met with on the branch lines and do it at a cost far below the amount that is now being spent for the operation of steam equipment.

The Minnesota Northwestern Electric Railway has been operated since August, 1914, by means of a gas-electric self-propelled motor car. One car of the type shown and described has successfully handled all of the



GASOLINE-ELECTRIC MOTOR CAR ON MINNESOTA NORTHWESTERN ELECTRIC RAILWAY

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business. The data shown are an average for four years' operation. The cost figures are necessarily higher than would have obtained a few years ago. The cost of operation per car-mile also includes the haulage of a considerable amount of freight.

The line of the Minnesota Northwestern runs a distance of 20 miles from Thief River Falls, Minn., a town of 6000 inhabitants, to Goodridge, Minn., a town of 500. When the line was originally planned the intention was to construct 20 miles each year, but these plans were frustrated by the war. At Thief River Falls there are connections with the Minneapolis, St. Paul & Sault Ste. Marie Railway and the Great Northern Railway. The passenger and freight depot of the Soo Line is used for the Thief River Falls terminus of this line. The entire territory that the line runs through is a partially developed agricultural section that twelve years ago was Indian reservation. All of the business obtained along the line is from agricultural products or products manufactured for consumption in the district. The line runs through open prairie country, so that the grade was made entirely by means of side borrow work. The borrow pits were made continuous in the form of ditches for thoroughly draining the right-of-way. The roadbed consists of 72 lb. per yard steel rails laid on 6-in. x 8-in. tamarack ties, spaced eighteen to the 30-ft. rail. The line is gravel ballasted practically the entire length. The maximum gradient is 0.3 per cent and the maximum curvature is 6 deg.

EQUIPMENT IS GASOLINE-ELECTRIC

The type of equipment used is a gasoline-electric motor car, manufactured by the General Electric Company, of Erie, Pa., and designated Type RE-70-B-11, of the following general dimensions:

Length over bumpers	70 ft. 1¼ in.
Length of passenger compartment	30 ft. 5⅜ in.
Length of smoking compartment	12 ft. 5 in.
Length of baggage compartment	10 ft. 11 in.
Length of engine compartment	11 ft. 11 in.
Distance between bolster centers	53 ft. 7 in.
Total wheelbase	60 ft. 0 in.
Net weight of car	52 tons
Drawbars	Front, ¾ M.C.B.; rear, full M.C.B.
Width over all	10 ft. 6½ in.
Height above rail	14 ft. 7¾ in.
Journals	5½x10 in. and 5x9in.

The frame of the car is constructed entirely of steel, suitably cross-braced with I-beams and channels. The outside sheathing is of steel plates. The floor is made up in three layers of steel, wood and felt. The interior trim is of mahogany with a composite ceiling. The windows are fitted with plate glass and can be opened to a height of 2 ft. The seats are of the bench type with spring backs and seats, heavily upholstered in plush in the main compartment and leather in the smoker. The seats are wide enough to accommodate three passengers comfortably. The interior of the car is brilliantly illuminated by means of incandescent lamps. The heating is by means of hot water furnished from a Peter Smith heater in the baggage compartment. The seating capacity is ninety-one.

Energy is transmitted from the gas engine to the driving wheels by means of electric drive. The power plant consists of an eight-cylinder, 550-r.p.m., 4-cycle gas engine of the "V" type, rated at 200 hp., direct connected to a 600-volt generator of 80-kw. capacity, but which is capable of very large overloads for short periods. The generator supplies power to two Type GE-205 railway motors of 100 hp. each, mounted on the front truck, and gear-connected to the axles. The air-brake equipment consists of an air compressor of 22.5 cu.ft. per minute capacity, directly driven from the main engine, with an auxiliary compressor of 45 cu.ft. per minute driven by a separate engine set of 5 hp., which also drives the generator for supplying electricity for car and headlights. The auxiliary compressor is used for starting the engine by means of compressed air. The brakes are General Electric straight and automatic with a 14-in. brake cylinder.

OPERATING CAB OF THE MOTOR CAR

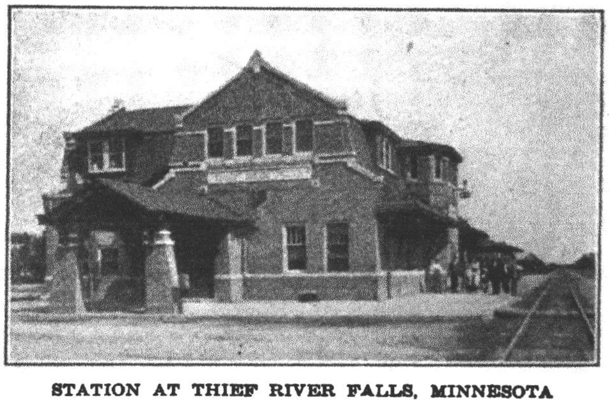
BOTH PASSENGER AND FREIGHT SERVICE IS MAINTAINED

At the present time two trains daily in each direction are operated, one train in each direction being a passenger train only and one train in each direction a mixed train. The running time of the passenger trains is fifty minutes and the mixed trains sixty minutes. There are three regular stations in the 20 miles, although stops for passengers are made at each mile, on signal. The train crew consists of one engineer and one conductor, who do all of the work necessary to the handling of the mail, express and freight business in addition to the regular work of collecting fares and tickets.

The performance of the motor car in passenger service only, based on operation over track of ordinarily good construction, with the distance between stops as shown and figuring the average duration of stops as thirty seconds, is shown in Table I. This table is based on a motor gearing of a seventeen-tooth pinion

TABLE I—PERFORMANCE OF CAR IN PASSENGER SERVICE

Average distance between stops	Schedule Speed in Miles per Hour				
Per Cent Grade	1 Mile	2 Miles	3 Miles	5 Miles	Free Running Speed
Level	20.5	28.0	32.0	37.0	49.0
0.50	19.0	25.0	28.0	31.0	41.0
1.00	17.5	22.0	24.0	26.0	31.5
1.50	15.5	18.0	20.0	21.0	23.5
2.00	13.5	15.0	16.0	17.0	18.5



STATION AT THIEF RIVER FALLS, MINNESOTA

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TABLE II—PERFORMANCE OF CAR IN MIXED PASSENGER AND FREIGHT SERVICE

Total Train Tonnage	Schedule Speed, Miles per Hour	Schedule Speed No Stops
52	32.0	49.0
100	26.0	40.0
150	22.0	30.0
200	16.0	20.0
250	14.0	17.0
300	12.0	15.0

For periods not to exceed fifteen minutes this car will pull a maximum trailing load of 500 tons.

TABLE IV—OPERATING RESULTS OF THE MINNESOTA NORTHWESTERN

Year	1915	1916	1917	1918	Total
Motor car-miles	36,363	32,633	26,893	26,612	122,501
Number freight cars hauled	1,610	1,268	1,456	1,864	6,198
Freight-car miles	27,305	21,410	24,605	31,596	104,916
Revenue passengers carried	36,045	31,243	29,176	26,790	123,254
Revenue freight hauled (tons)	17,416	13,608	15,470	19,864	66,358
Fuel consumption (gallons)	22,970	21,832	18 033	18,756	81,591
Lubricants (gallons)	473	356	542	322	1,693
Motor-car miles per gallon of fuel	1.58	1.50	1.49	1.42	......

TABLE III—DATA REGARDING SERVICE AND OPERATING DELAYS OVER A FOUR-YEAR PERIOD

Year	1915	1916	1917	1918	Total
Days in service	311	318	312	314	1,255
Days out of service (overhaul)	6	0	8	0	14
Car-hours in service	3,420	2,994	2,405	2,490	11 309
Delays due to equipment failure	3	2	1	1	7
Duration of above delays in hours (total)	4	3	1	2	10

TABLE V—COST OF OPERATING AND MAINTAINING A GASOLINE-ELECTRIC CAR

Item	Cost Per Year	Cost Per Car-Mile
Maintenance of car body and trucks	$89.50	$0.00292
Maintenance of electric equipment	98.40	.00321
Maintenance of gas engines	45.0°	.00147
Other power supplies and expenses	29.99	.00098
Fuel for power	3,386.86	.11059
Lubricants	175.26	.00572
Wages, engineer and trainmen	2,950.00	.09632
Carhouse employees and expenses	1,266.62	.04130
Total	$8,041.66	$0.26251

and fifty-eight-tooth gear. Higher schedule speeds may be obtained by change of gearing. The speeds given in the table are for average gradients of the amount shown.

Table II shows the performance of the motor car in mixed passenger and freight service, as determined from actual conditions on this line. This table is based on service with stops of five minutes each every 5 miles and for continuous runs of not exceeding 50 miles. Where the runs are longer, stops must be longer, when heavy trains are pulled, in order to prevent overheating of motors and generator. The table is also based on the same gearing as shown in Table I and on level track.

Reliability is one of the prime requisites for railroad operation. The gas-electric motor car possesses this in marked degree. With ordinary care during layover periods, and the chances provided for making minor repairs by the fact that the majority of the branch lines do not operate on Sunday, we have found it is necessary to overhaul this type of equipment only every two years. Table III shows the service rendered during the past four years.

Table IV shows that this type of motor car can be relied upon to handle all of the business (both passenger and freight) that usually is found upon branch lines.

The data shown in Table V on cost of operation are based on gasoline at 17 cents per gallon, lubricating oil at 42 cents per gallon, wages of engineer at $160 per month, wages of conductor at $85 per month and carhouse employees at $75 per month. All of these figures are the average paid by this company during the past four years of operation. The costs given embrace all of the expenses directly chargeable to motor car operation, but do not include any depreciation or interest. The figures are for operation of both passenger and freight service. Where the motor car is used for passenger service only the cost is considerably less. Or if the mileage operated is greater the figures per car-mile are less. This is based on an average of 90 miles per day.

For branch lines of approximately 100 miles, the ideal equipment for economical operation is light-weight motor cars of not exceeding 25 tons, with baggage compartment, capable of seating at least sixty passengers and of making a schedule speed of 35 m.p.h. Such cars would take care of all of the passenger requirements usually met with, especially if the power provided was sufficient to haul one light-weight trailer. These motor cars could be operated at a maximum of 15 cents per train-mile.

For the freight service the ideal equipment would be crude oil locomotives capable of hauling trains of 500 to 800 tons at a speed of 20 to 25 m.p.h. The cost of operating this type of equipment would be less than half of that required for steam operation, as all expenses for fuel, etc., cease as soon as the engine stops. Also they are capable of storing fuel for runs of 250 to 500 miles without replenishing. They need no water or fuel stations along the line.

Kilowatt-hours in February

The United States Geological Survey has been conducting a census of energy production on returns received from 3150 electric power plants engaged in public service, including central stations, electric railways and certain other plants, the output of which contributes to the public supply. The returns received represent about 85 per cent of the total generating capacity. For plants which did not make returns or which were unable to furnish the data requested, estimates of output were made from available information. The output for the month of February average 110,000,000 kw.-hr. per day, of which 39 per cent was produced by water power.

THOUSANDS OF KILOWATT-HOURS PRODUCED IN FEBRUARY

State	By Water-Power	By Fuels	State	By Water-Power	By Fuels
Alabama	39,372	12,939	Montana	69,220	1,552
Arizona	3,967	16,395	Nebraska	810	16,022
Arkansas	77	6,275	Nevada	2,913	137
California	190,462	38,295	New Hampshire	4,660	2,188
Colorado	13,161	17,271	New Jersey	165	79,153
Connecticut	12,419	38,643	New Mexico	59	1,272
Delaware	0	5,549	New York	204,590	288,986
			North Carolina	43,234	2,820
District of Columbia	0	18,094	North Dakota	0	2,308
Florida	678	11,257	Ohio	2,309	181,766
Georgia	35,497	7,236	Oklahoma	223	12,092
Idaho	42,050	259	Oregon	27,034	3,259
Illinois	13,701	241,930	Pennsylvania	55,066	243,098
Indiana	3,761	56,151	Rhode Island	383	28,767
Iowa	44,214	23,110	South Carolina	64,745	3,235
Kansas	1,267	29,203	South Dakota	4,624	3,751
Kentucky	4	18,900	Tennessee	43,780	8,368
Louisiana	0	14,034	Texas	165	43,151
Maine	16,611	132	Utah	48,906	0
Maryland	278	18,448	Vermont	13,777	209
Massachusetts	19,147	102,844	Virginia	17,693	17,685
Michigan	49,980	97,187	Washington	71,160	5,667
Minnesota	24,525	28,708	West Virginia	1,453	51,584
Mississippi	0	5,789	Wisconsin	28,284	32,709
Missouri	4,297	37,212	Wyoming	251	3,542
Total				1,220,972	1,879,182
Combined total				....	3,100,154

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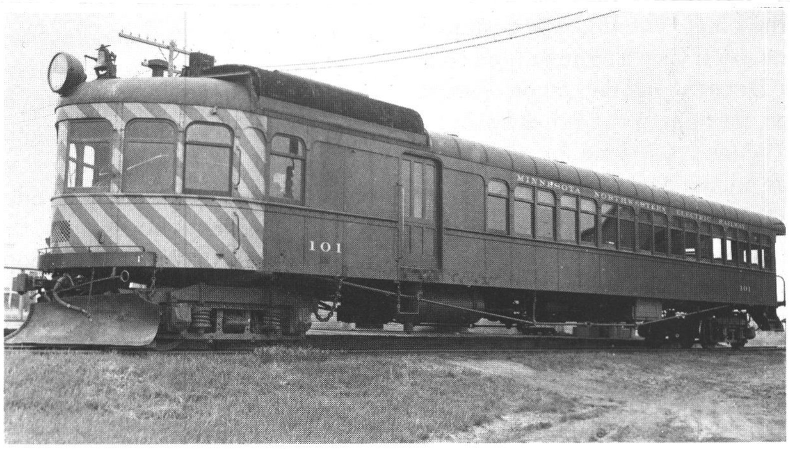

101
MINNESOTA NORTHWESTERN ELECTRIC RAILWAY
101

INDUSTRIAL ELECTRIC RAILWAYS

- Minneapolis Municipal Waterworks Railway
- Central Warehouse Company
- Various Iron Ore Mining Operations

MINNEAPOLIS MUNICIPAL WATERWORKS RAILWAY

Columbia Heights, Minnesota

When the City of Minneapolis constructed a water purification plant in the suburb of Columbia Heights, adjacent to northeast Minneapolis, freight was hauled by teams and trucks from a siding on the Soo Line Railway to the plant, a distance of about 1½ miles on a heavy grade. It was decided to construct an electric railroad from the steam railroad siding to the plant. The line was designed by F. W. Cappelen, Minneapolis City Engineer. Construction was by Waterworks Department day labor, except for the laying of rails and erection of overhead trolley wire and feeder cables, which was performed by the Minneapolis Street Railway.

Statistics on the project included the following.

1. Approximately 8,000 l.f. of main line track plus 2,000 l.f. of construction and passing tracks.
2. 6" crushed rock base, crushed rock ballast, 6"x8"x8'0" sawed red oak ties. 7" 80 lb. T rail (copper bonded) on tangents. Curved track construction consisted of 91 lb. T rail outside and 7" 127 lb. MCB flange rail inside.
3. 7" 30 ft. cedar overhead line poles. Feeder cable was connected to the Mpls. St. Ry. system and power furnished under contract with Mpls. St. Ry.
4. Elevation was 0.0 at Central Ave. N.E. and Reservoir Boulevard, and 123.4 at the plant. Grades ranged from 2% to 5%.
5. A one-stall frame carhouse with concrete pit was built on Reservoir Blvd. near the plant.

The line was completed in October 1917 and opened for service during November. At the time of completion it was referred to as the Minneapolis Filtration Plant Railway. Data reported in the U.S. Censuses was always listed under the title Minneapolis Municipal Waterworks Railway.

The only piece of equipment owned by the railway was car number 1 built by the McGuire-Cummings Manufacturing Co., Paris, Illinois, during 1917 according to designs furnished by the Minneapolis City Engineer. (A drawing exists in the TCRT Co's. Transit Supply Company files; we don't know if they were asked to bid on constructing the car.) The car was designed for carrying passengers as well as pulling railroad freight cars. Equipped for double-end operation, the motorman's cab doors and passenger center entrance/exit doors were located on one side of the car only. The reason was that the operation was over side-of-the-road track with heavily wooded areas adjacent to the other side of the track. Data: McGuire trucks with four G.E. 73 motors (75 h.p. each), Type M multiple-unit control with two C-101-A master controllers, combination automatic and straight air brakes, MCB couplers, seated 36 persons and weighed 43,000 pounds. The car was painted maroon, with gold window sash, and black roof, bumpers, and underbody equipment.

The car could handle one loaded freight car per trip up the grade to the plant, and several empty cars downgrade. The track ended at the head house of the filter plant where deliveries of coal, powdered alum, chlorine, ammonia, and a special sand (from the Mississippi River for use in the filters) could be made directly to the bunkers and bins. A passing track allowed the motor car to run around the loaded freight cars. Branch tracks were for construction deliveries and switching purposes. The car was operated during the morning and evening shift changes providing free transportation for the employees between the plant and the Mpls. St. Ry. line on Central Ave. N.E. at 37th Ave. N.E. The freight shipments were handled during the middle of the day between shifts.

Passenger service was subsequently made available to the general public as the area gradually built up with residences. Fare was three cents one way. The first public passenger schedule was as follows.

Leave Filtration Plant	Leave 37th Ave.N.E. and

	Central Ave. N.E.
7:30 a.m. daily	7:45 a.m. daily
8:00 a.m. daily	8:15 a.m. daily
11:30 a.m. daily	11:45 a.m. daily
1:45 p.m. daily	2:00 p.m. daily
3:30 p.m. daily	3:45 p.m. daily
4:00 p.m. daily	4:15 p.m. daily
4:45 p.m. daily	5:00 p.m. daily
5:30 p.m. daily	5:45 p.m. daily
6:30 p.m. Sundays Only	6:45 p.m. Sundays only

Freight switching was performed between passenger trips. Usually only one round trip per day for freight purposes was required.

The U. S. Census listed first track 1.50 miles, sidings 0.10 miles, and total track 1.60 miles. Engineering drawings give an exact figure of 1.583 miles.

Other figures from the U. S. Censuses of:	1927	1932
KWH of electricity used	34,056	32,000
Employees carried free	14,600	23,424
Fare paying passengers carried	5,681	2,488
Total passengers carried	20,281	25,912
Car miles operated	8,760	8,784
Passenger Revenue	$ 170	$ 74
Operating Expenses	$4,662	$4,720
Deficit	($4,492)	($4,646)

Servicing and minor repairs to the car were done in the railway's carhouse. Major repairs and overhauls were performed by TCRT Co.'s Transit Supply Co. in the Snelling Shops, St.Paul. Since there was no switch connecting the two lines, only a crossing, the procedure used to switch cars between lines was to derail the car, then rerail it, one truck at a time, from one track to the other. Mpls. St. Ry. supplied one of its double-end cars (usually 847 or 876, and later number 4) for passenger service during such overhaul periods while freight service was provided by the Soo Line Railway with a steam locomotive.

The line's only motorman from 1917 until 1952 was Myron Handy, a former Soo Line fireman and Mpls. St. Ry. motorman.

An unusual incident occurred April 6, 1944, when the car got away unattended at 37th and Central Avenues. It ran downhill on Central Avenue, through the derail at the Soo Line Ry. connection without difficulty, and on down the Soo Line main line until the automatic air applied the brakes. Frantic searching finally located the car and a Soo Line switcher pushed the undamaged car back to its own track.

The last public passenger schedule was in effect from June 16, 1941, until May 1, 1948, when all passenger service was discontinued.

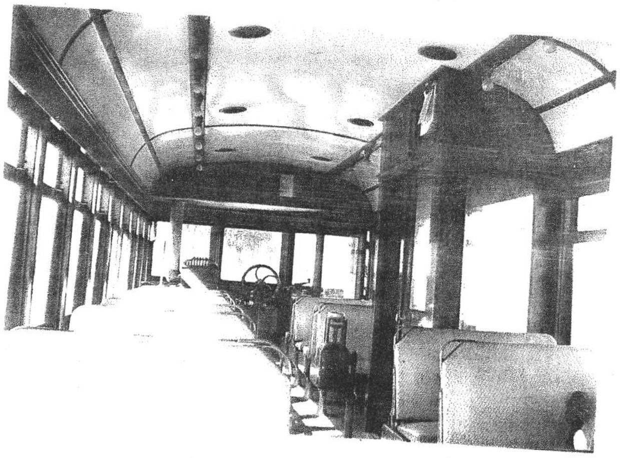
Leave Filtration Plant	Leave 37th Ave. N.E. and Central Ave. N.E.
7:30 a.m. daily	7:45 a.m. daily
8:00 a.m. daily	8:15 a.m. daily
12:00 noon daily	12:15 p.m. daily
1:45 p.m. daily	2:00 p.m. daily

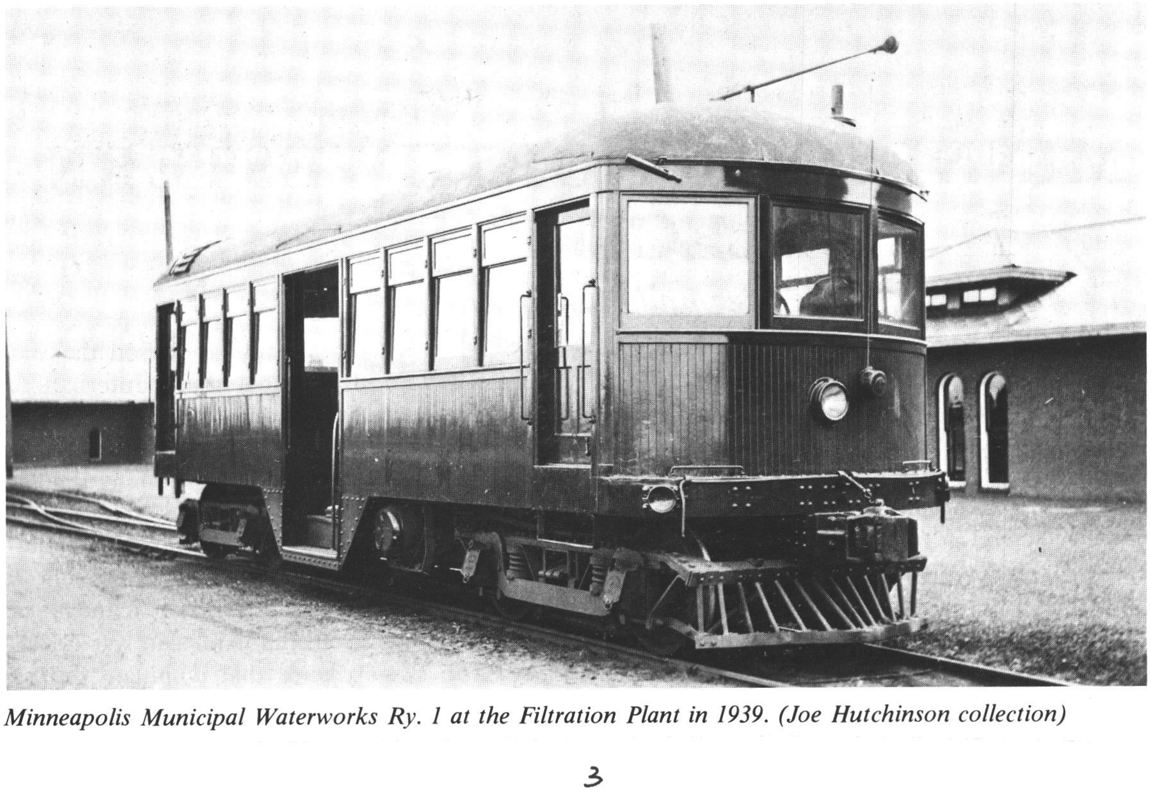
3:30 p.m. daily	3:45 p.m. daily
4:00 p.m. daily	4:15 p.m. daily
4:45 p.m. weekdays only	5:00 p.m. weekdays only

The fare was still only three cents!

Freight only operations continued. When Mpls. St. Ry. announced its intention of abandoning the streetcar line on Central Ave. N.E. the City of Minneapolis decided it was not feasible to purchase power from another source and prepared to discontinue rail operation in favor of trucks. The last run was made Friday, May 15, 1953.

Car number 1 was subsequently sold to the Sam Bloom Iron & Metal Company, 1600 2nd St. N., Minneapolis. On August 20, 1953, it was pulled out of the carhouse by a truck, then coasted downhill to the Soo Line Railway connection where a railroad switcher hauled it to the scrap yard. The car supposedly resold later to a contractor for use as a railroad construction office.

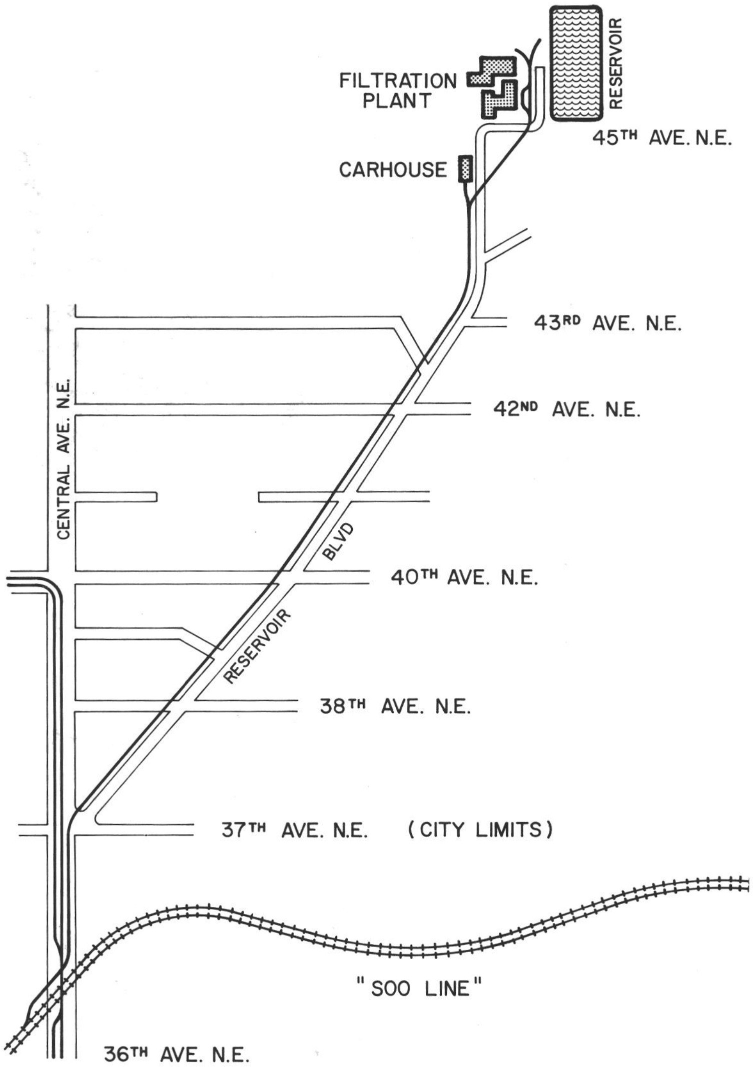


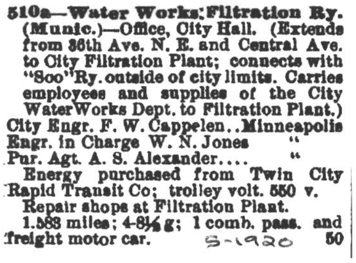


Minneapolis Municipal Waterworks Ry. 1 at the Filtration Plant in 1939. (Joe Hutchinson collection)

MINNEAPOLIS MUNICIPAL WATERWORKS RY.

COLUMBIA HEIGHTS, MINNESOTA





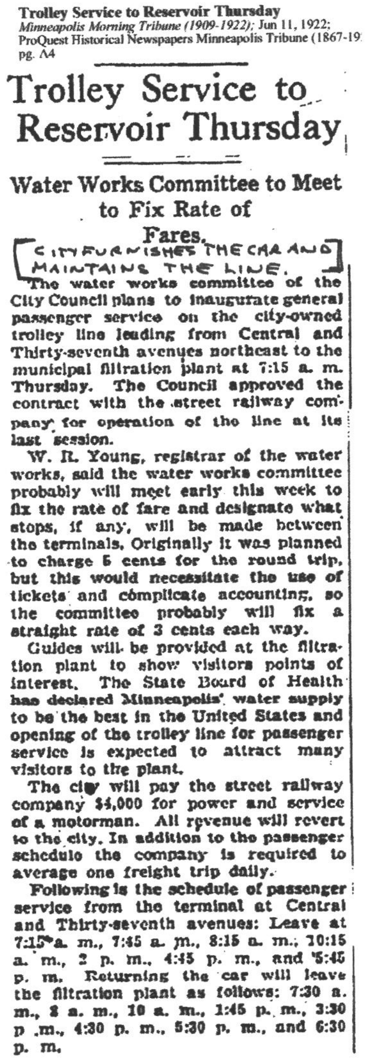
510a—Water Works Filtration Ry. (Munic.)—Office, City Hall. (Extends from 36th Ave. N. E. and Central Ave. to City Filtration Plant; connects with "Soo" Ry. outside of city limits. Carries employees and supplies of the City WaterWorks Dept. to Filtration Plant.)

City Engr. F. W. Cappelen..Minneapolis
Engr. in Charge W. N. Jones "
Pur. Agt. A. S. Alexander.... "

Energy purchased from Twin City Rapid Transit Co; trolley volt. 550 v.

Repair shops at Filtration Plant.

1.583 miles; 4-8½ g; 1 comb. pass. and freight motor car. 5-1920 50



Trolley Service to Reservoir Thursday
Minneapolis Morning Tribune (1909-1922); Jun 11, 1922;
ProQuest Historical Newspapers Minneapolis Tribune (1867-19
pg. A4

Trolley Service to Reservoir Thursday

Water Works Committee to Meet to Fix Rate of Fares.

[CITY FURNISHES THE CAR AND MAINTAINS THE LINE.]

The water works committee of the City Council plans to inaugurate general passenger service on the city-owned trolley line leading from Central and Thirty-seventh avenues northeast to the municipal filtration plant at 7:15 a. m. Thursday. The Council approved the contract with the street railway company for operation of the line at its last session.

W. R. Young, registrar of the water works, said the water works committee probably will meet early this week to fix the rate of fare and designate what stops, if any, will be made between the terminals. Originally it was planned to charge 5 cents for the round trip, but this would necessitate the use of tickets and complicate accounting, so the committee probably will fix a straight rate of 3 cents each way.

Guides will be provided at the filtration plant to show visitors points of interest. The State Board of Health has declared Minneapolis' water supply to be the best in the United States and opening of the trolley line for passenger service is expected to attract many visitors to the plant.

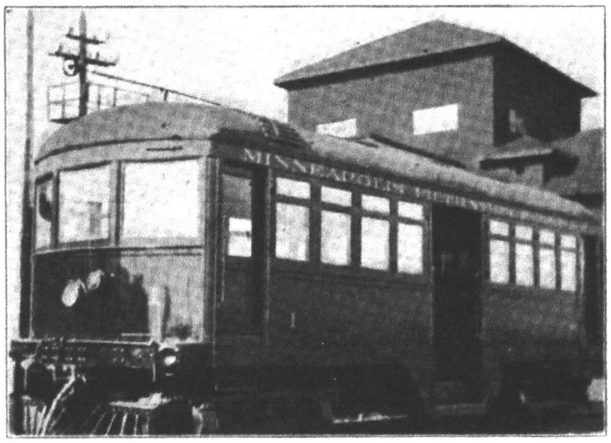
The city will pay the street railway company $4,000 for power and service of a motorman. All revenue will revert to the city. In addition to the passenger schedule the company is required to average one freight trip daily.

Following is the schedule of passenger service from the terminal at Central and Thirty-seventh avenues: Leave at 7:15 a. m., 7:45 a. m., 8:15 a. m., 10:15 a. m., 2 p. m., 4:45 p. m., and 5:45 p. m. Returning the car will leave the filtration plant as follows: 7:30 a. m., 8 a. m., 10 a. m., 1:45 p. m., 3:30 p. m., 4:30 p. m., 5:30 p. m., and 6:30 p. m.

MINNEAPOLIS FILTER PLANT RAILWAY

The water purification plant of the City of Minneapolis is located at Columbia Heights, six miles distant from the heart of the city. The works at present have a capacity of 54,000,000 gal. daily which is now being increased to 75,000,000 gal. daily. The water is pumped from the Mississippi river to the plant, a distance of three miles, and raised 250 ft. After purification by the mechanical or rapid sand filter process, the water flows from the clear water basin to the distribution system by gravity.

The original plant was completed in 1913. Such materials of construction as were supplied by local dealers were delivered by team or truck. Materials arriving in carload lots were set out on track at the nearest point which was one and one-half miles distant from the plant. From this point they, together with supplies for operation of the plant, such as coal and alum, were unloaded and hauled to the site by teams or trucks. On account of the long haul and heavy grades this method proved expensive and at the present time with increased wages for teams and labor would almost be out of the question.



Center Entrance Car of Minneapolis Filter Plant Railway

When the present increase in capacity was undertaken it was considered advisable to construct an electric railway from the Soo Line switch at 36th Avenue, N. E., and Central Avenue, to the plant not only for the purpose of transporting carload shipments to the works, but also to carry the employes and laborers to and from the plant. It was concluded that the railway would not only go a long way toward defraying its own cost, but would also decrease the present cost of operation as well as prove a great convenience to the men.

This railway was completed and put into operation in November, 1917. It has a total length of 8,000 ft. of main line and about 2,000 ft. of construction and passing tracks. It is connected at the lower end to the Soo Line Railway and runs parallel to the street railway tracks for a short distance in Central Avenue and then turns off onto the Reservoir Boulevard, a thoroughfare owned by the city and connected with the filtration plant. The roadbed takes the grades established on the boulevard and rises from the point of beginning to terminus a total height of 123.4 ft. Some of the important grades vary from 2 to 5%. The two sharpest curves are at the lower end and are each 20 deg.

The roadbed in Central avenue is in brick paving and is high T-rail construction. In the boulevard excavation was made 6 in. below sub-grade in order to bring the top of rail to the proper elevation which would be required for paving on this roadway.

Selected 6 in. x 8 in. x 8 ft. sawed red oak ties were used laid on 6 in. of crushed rock and ballasted with the same material. These ties were treated with creosote oil and tar, the impregnation being 10 lb. of oil per cu. ft.

A 7-in. 127-lb. M.C.B. flange inside rail and a 91-lb. T-rail were used on curves. On tangents 7-in. 80-lb. rails were used. All rails were copper bonded.

The overhead trolley consists of 7-in. 30-ft. cedar poles with treated butts and tops. The feed wire cable is connected to the Minneapolis Street Railway system and the power is furnished by this company to the city by contract.

The motor is a double-end, side door car and has a capacity of 38 passengers. It is equipped with four GE-73 motors, of 75 hp. each, and has combined and straight air brake equipment.

The track terminates at the head house of the filter plant where deliveries of coal, alum and other supplies can be made direct to bunkers and bins. A passing track is constructed here so that loaded cars may be left and the motor released for other work. Branch tracks are run for construction deliveries and switching purposes. A car house is provided for housing the motor car. This has a concrete pit by means of which the motors are made accessible for inspection and repairs.

The motor is used morning and evening on regular schedules for the transportation of the employes of the plant. During the day freight shipments are taken care of by transporting, switching and returning of empty cars. On account of the grades and curvature the motor brings up one car at a time, though several cars can be returned empty on the down grade.

The railway was built by the water works department by day labor except the laying of the rails and stringing of the trolley wire and feeder cable. This work was done by the street railway company for the city.

At the present time passenger traffic is limited to city employes and no charge is made for transportation. When construction work at the plant is completed so that the car can be released for regular schedules, general service will be considered including transfer privileges with the street railway company to take passengers to the city.

This work was done under the direction of Mr. F. W. Cappelen, city engineer.

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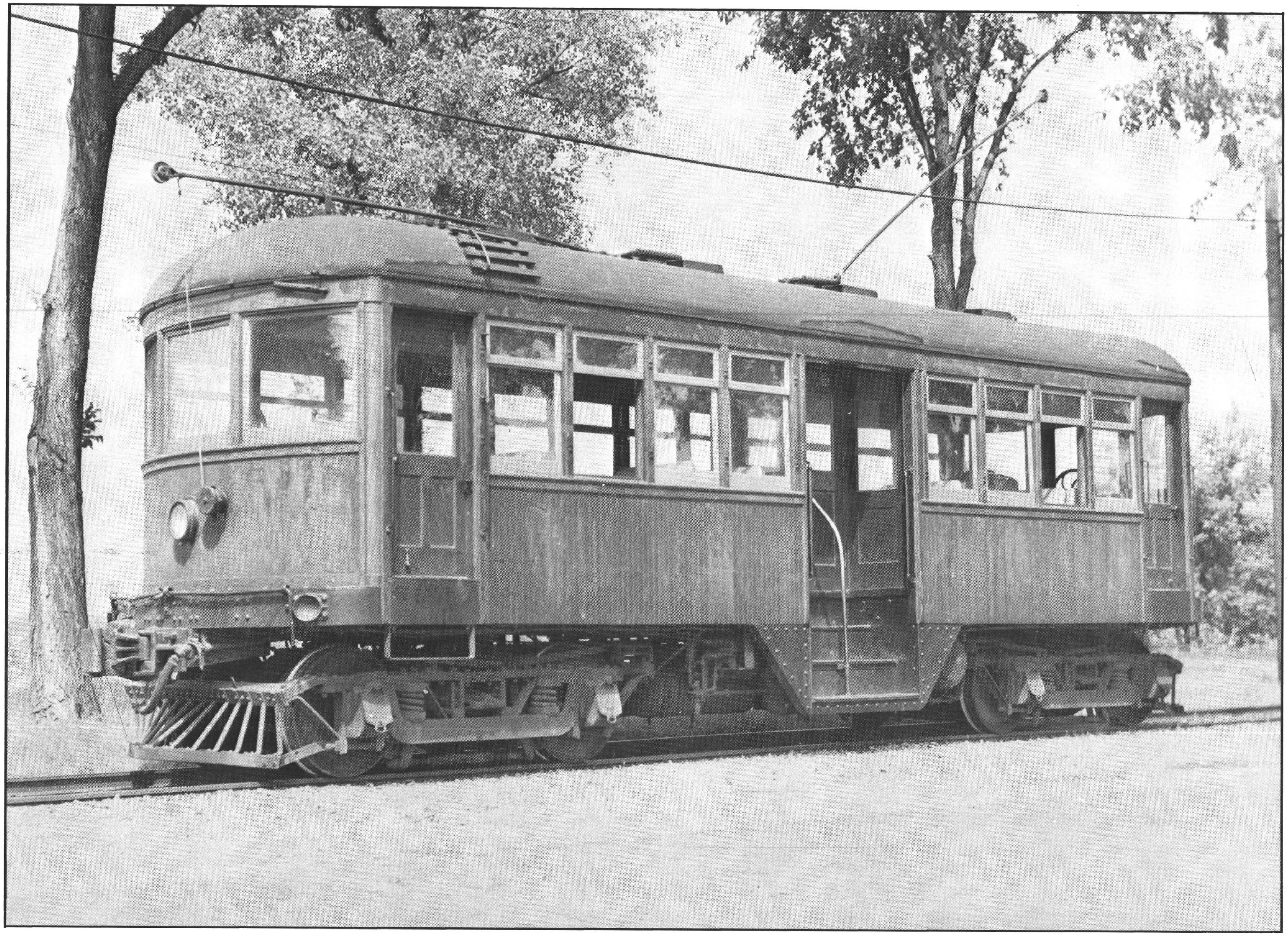
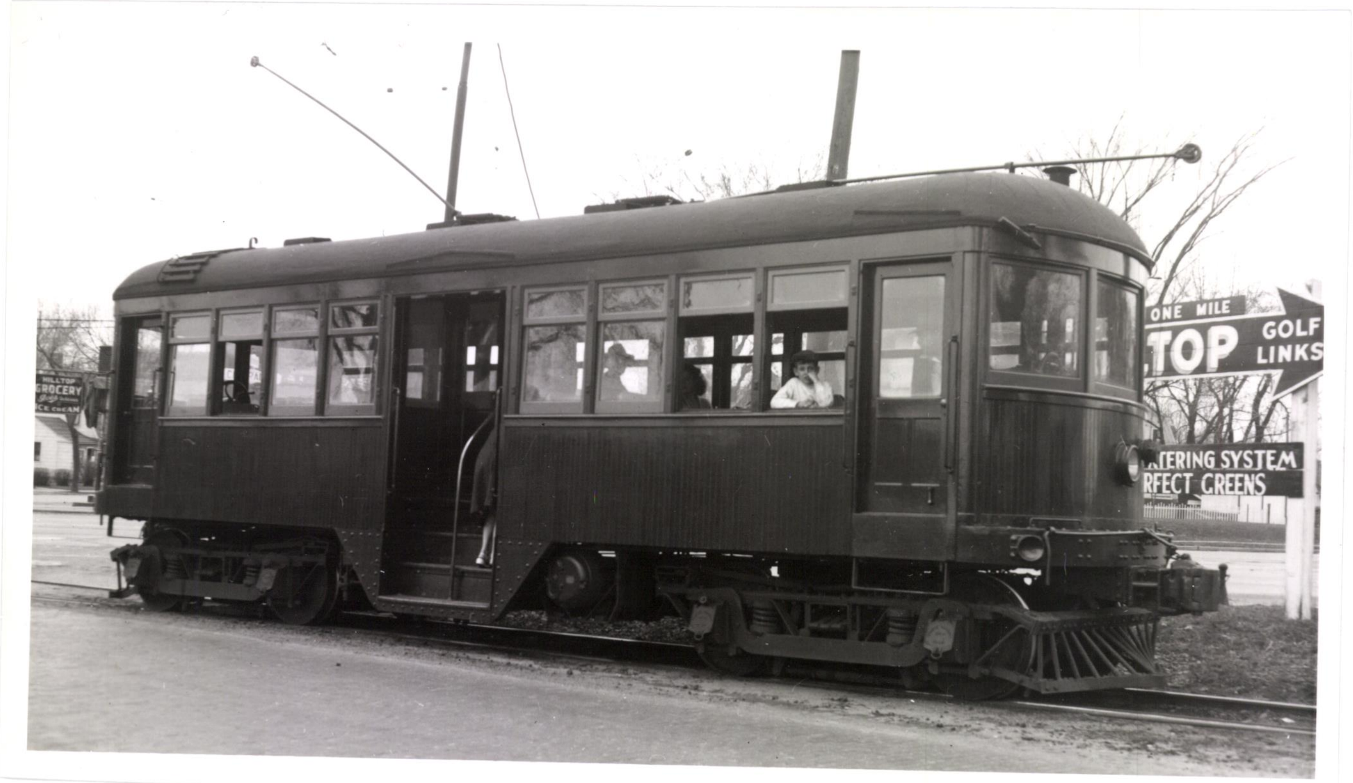
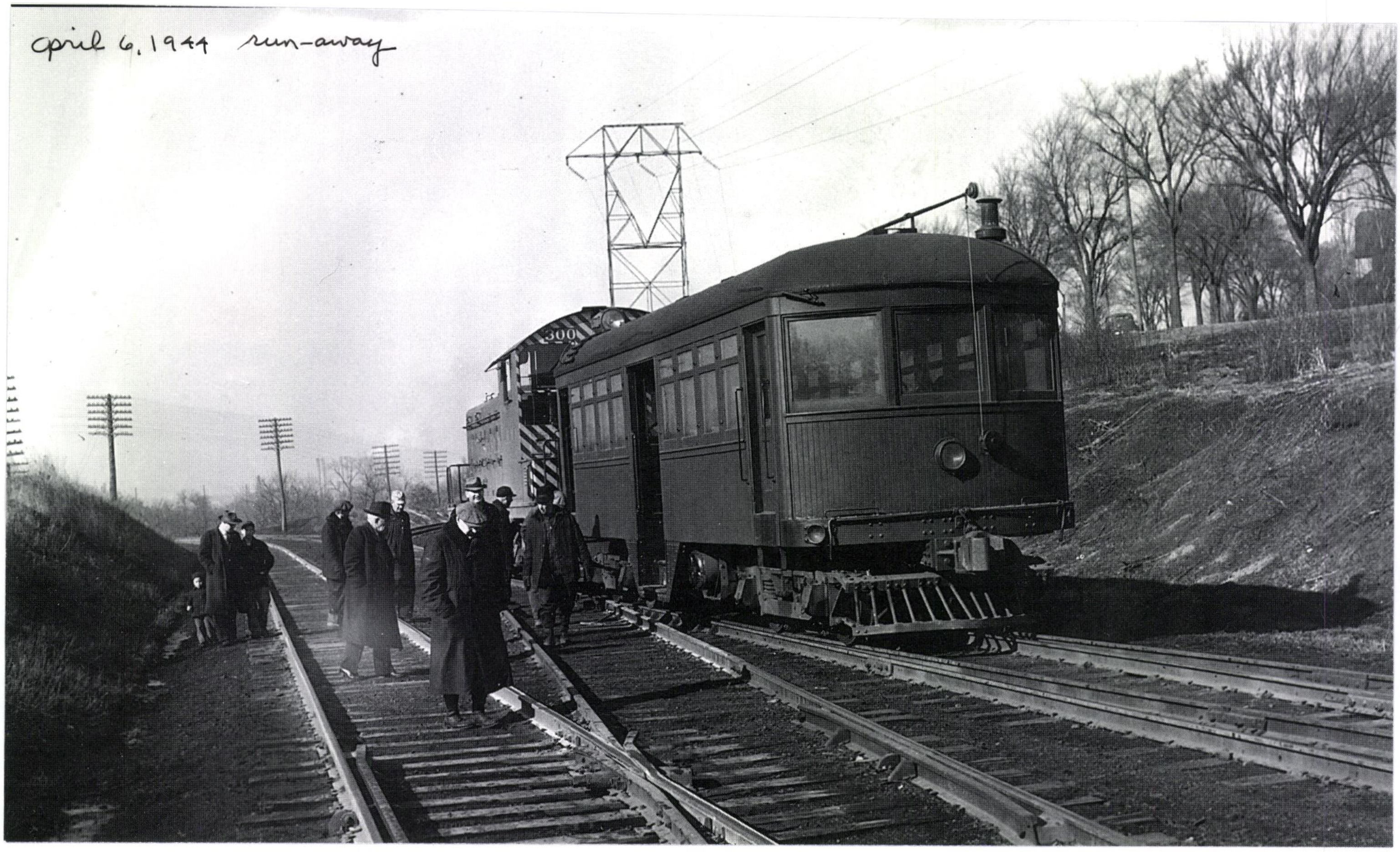
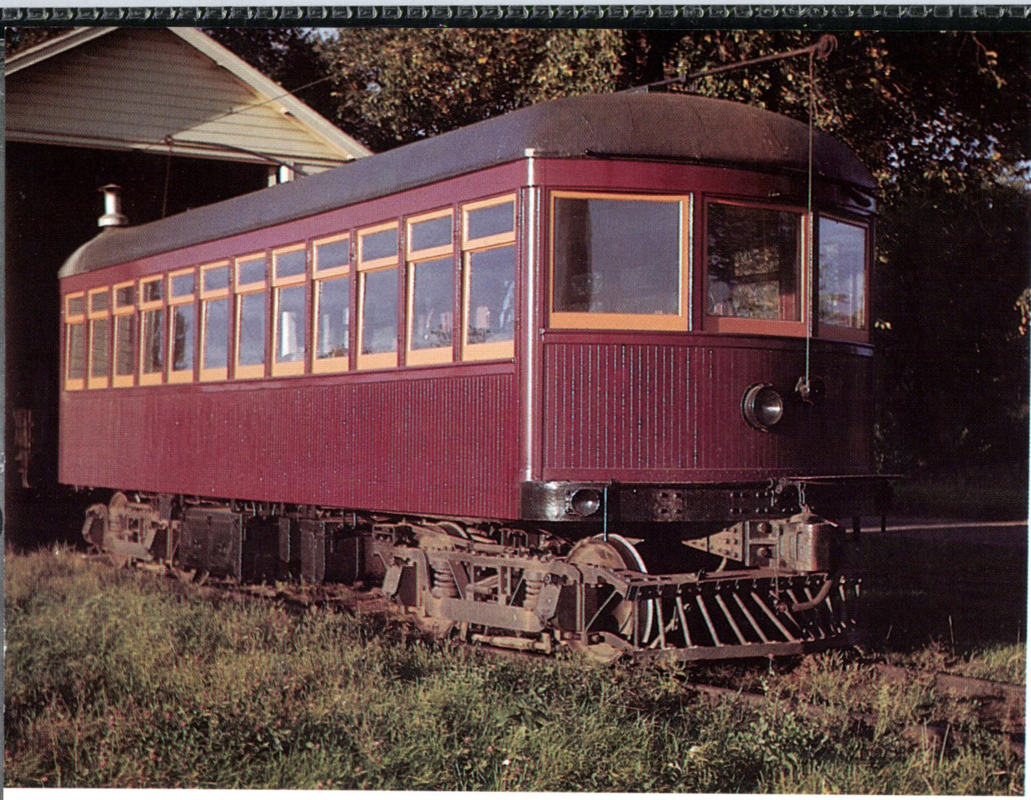



HILLTOP
GROCERY
ICE CREAM
ONE MILE
TOP
GOLF
LINKS
ATERING SYSTEM
RFECT GREENS



april 6, 1944 run-away



T. H. DESNOYERS (G. KRAMBLES) / October 1950 / Minneapolis, MN

◄ MINNEAPOLIS MUNICIPAL WATERWORKS RAILWAY 1

Filtration plant switching line

Soo Line R.R. to filtration plant in Columbia Hts., (Minneapolis) MN	(+) November 1917
Passenger service	(−) May 1, 1948
All remaining service	(−) May 15, 1953

Miles of line	1½
Power system	600 v DC trolley
Motor cars, 1953	This car, #1, only
Weight in tons	21.5
Motors, quantity / builder / rating	4 / GE-73 / 75 hp
Control, single or double end / type	DE / GE-M C101A
Approximate free speed	25 mph
Builder / year delivered	McGuire-Cummings / 1917

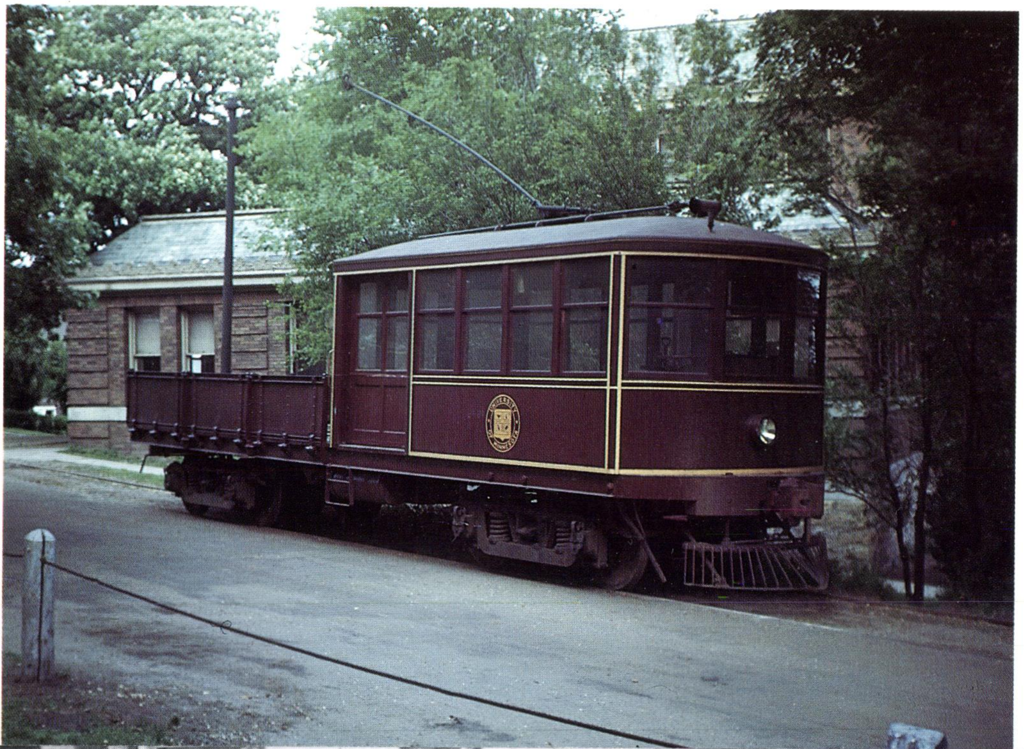
Built before the days of hard roads or private autos, this line brought employees to/from the nearest Twin Cities streetcar line and moved carloads of filtration plant materials such as chlorine and filter sand. When the neighborhood began to build up, the line offered service to the public at 3¢ a ride.

UNIVERSITY OF MINNESOTA 1 ►

St. Paul-Minneapolis, MN Intercampus line	(+) November 4, 1914
St. Paul-Minneapolis, MN Intercampus line	(−) June 19, 1954

Miles of line	2.5±
Power system	600 v DC trolley
Locomotive cars for freight switching	This car, #1, only
Length over buffer sills	37 ft.
Weight in tons	25.5
Motors, quantity / builder / rating	4 / GE-57 / 50 hp
Control	GE K-37
Builder/ year built	Twin City RT / 1914

This line had been built (at State expense) to provide for passenger access from connecting Twin Cities car lines to and between the Main Campus in Minneapolis and the Agricultural Campus in St. Paul. The University purchased this car for switching cars of coal, fertilizer, livestock and machinery in and out of both campuses.

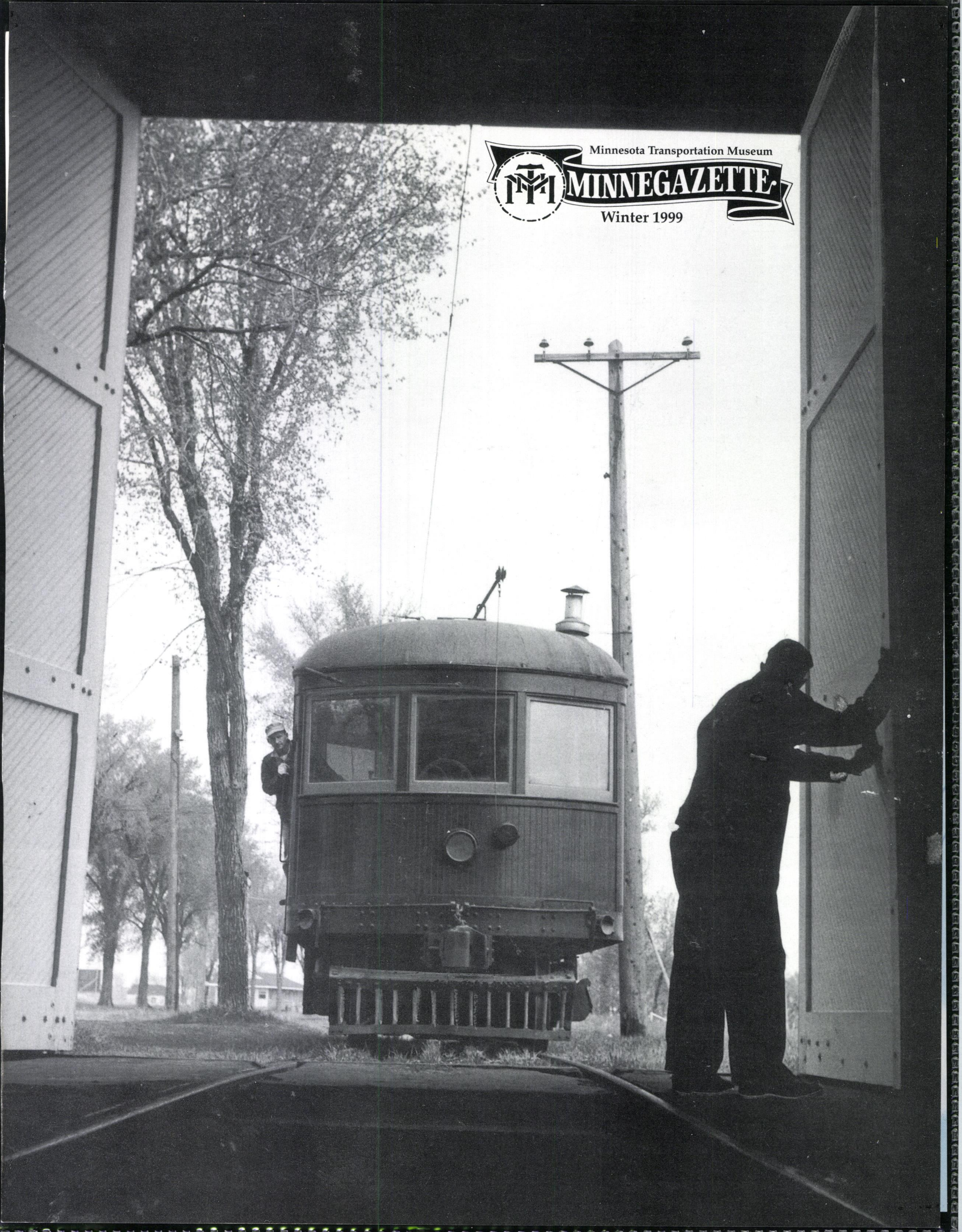


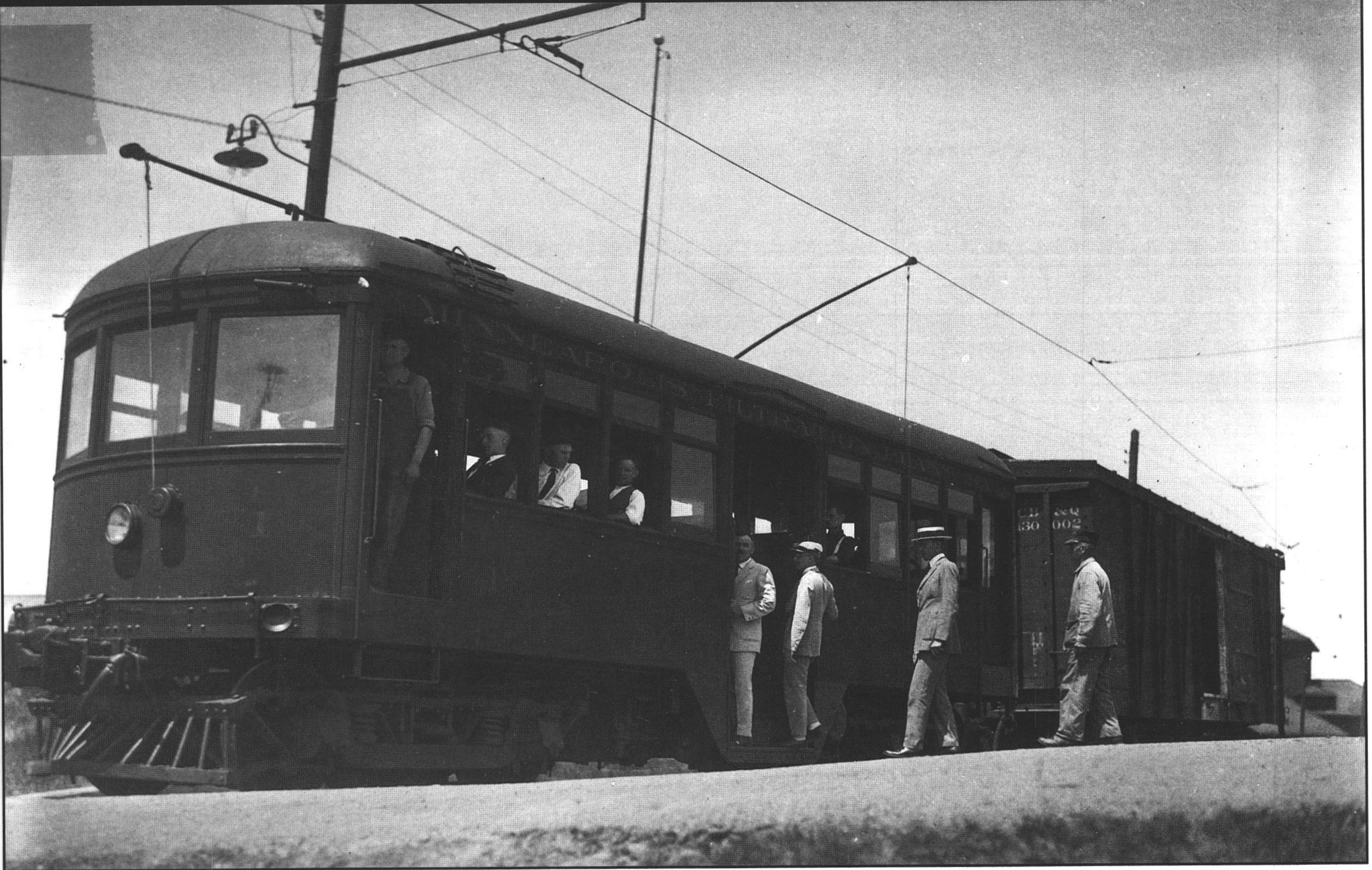
G. KRAMBLES / May 26, 1953 / St. Paul, MN

Minnesota Transportation Museum

MINNEGAZETTE

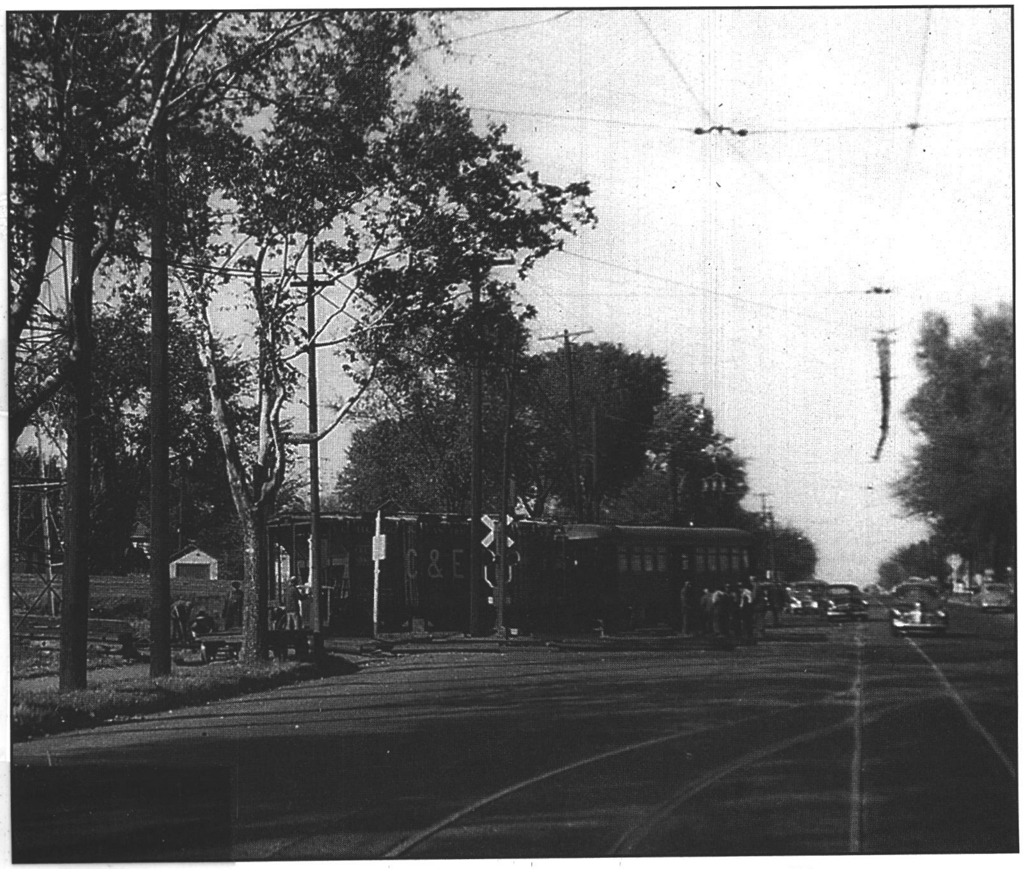
Winter 1999





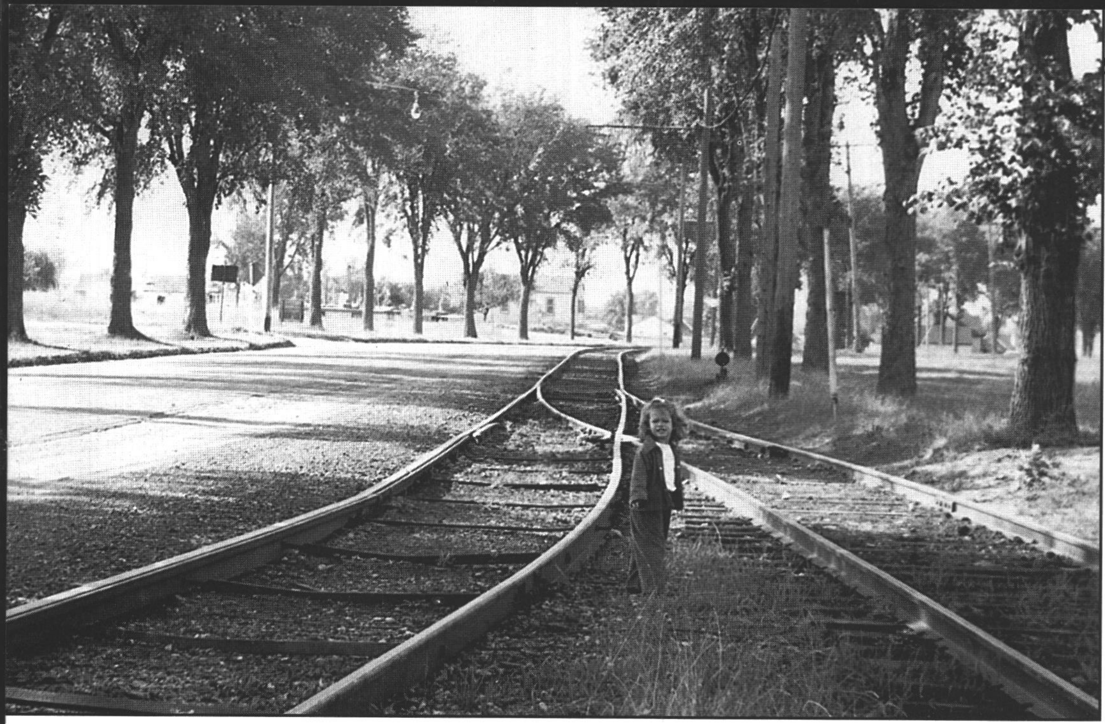
Sometime early in its career, #1 loads what is probably a group of employees at the plant. Note that the car was lettered and numbered, which wasn't the case in its later years. Also, the trolley poles have shoes. Later they switched to small trolley wheels, probably because of being shopped at Snelling. Minnesota Historical Society collection.

Turning off Central onto the interchange track. The Filtration Plant line had its own third track on the east side of Central. Southbound moves ran against traffic for one block. Meanwhile, the streetcar narrowed down to one track for the Soo grade crossing, standard TCRT practice. This is the very last freight move before abandonment. MTM collection.

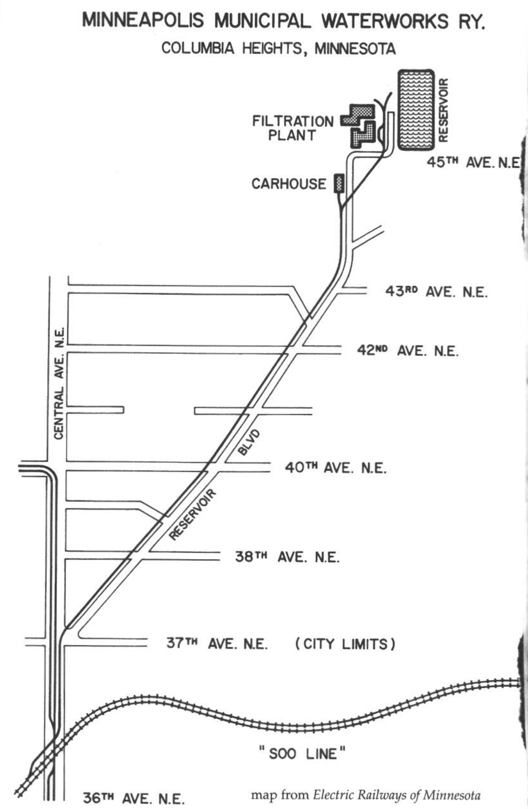


streetcar tracks to parallel the Soo Line, which crossed Central Avenue at that point. The Soo interchange track was the end of the line.

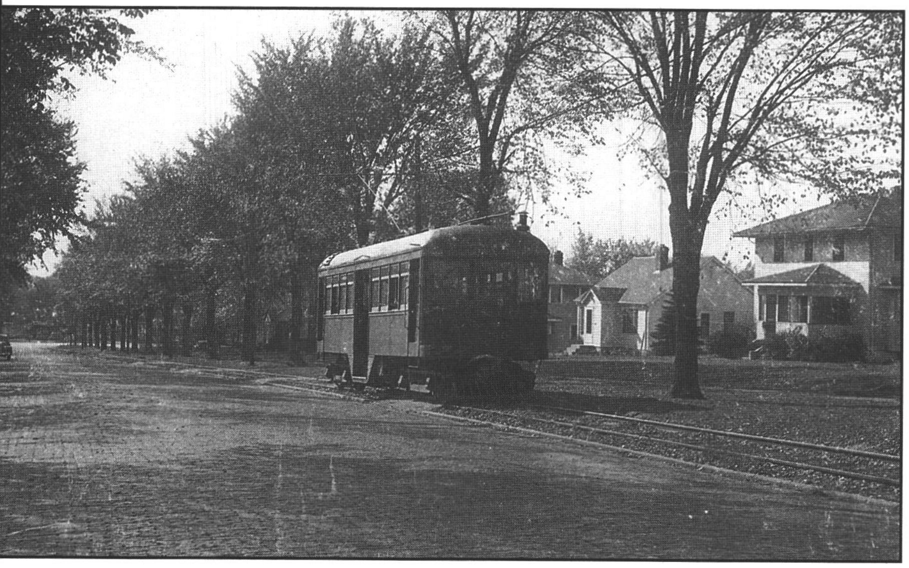
The railroad was built to haul both passengers and freight. It was electrified, purchasing its power from Twin City Rapid Transit. Its one piece of rolling stock was #1, a combined center door passenger car and freight motor. Weighing 43,000 pounds, about the same as a much longer standard Twin City streetcar, it was capable of hauling a single car up the steep grade or several coming down. The plant consumed coal, powdered alum, chlorine, ammonia and sand for its filters. #1 could seat 36 passengers and initially shuttled employees to and from the Central Avenue streetcars. As houses began to appear along the line, a scheduled service for the public was operated. Trips left the plant at 7:30 AM, 8:00, 11:30, 1:45 PM, 3:30, 4:00, 4:45, 5:30 and 6:30 (Sundays only). Departures from Central were 15 minutes later. This schedule varied slightly over the years, but the fare remained a bargain at 3



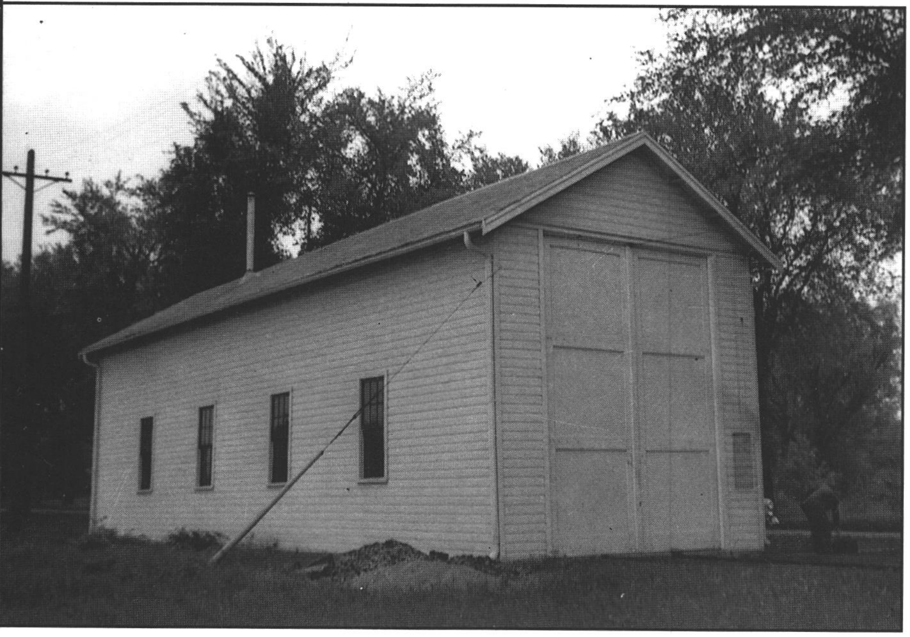
These two views illustrate the tree lined, side of the road operation along Reservoir Blvd. The little girl is standing between the main track and the carbarn spur. MTM collection


MINNEAPOLIS MUNICIPAL WATERWORKS RY.
COLUMBIA HEIGHTS, MINNESOTA
FILTRATION PLANT
RESERVOIR
45TH AVE. N.E.
CARHOUSE
43RD AVE. N.E.
42ND AVE. N.E.
CENTRAL AVE. N.E.
RESERVOIR BLVD
40TH AVE. N.E.
38TH AVE. N.E.
37TH AVE. N.E. (CITY LIMITS)
"SOO LINE"
36TH AVE. N.E.

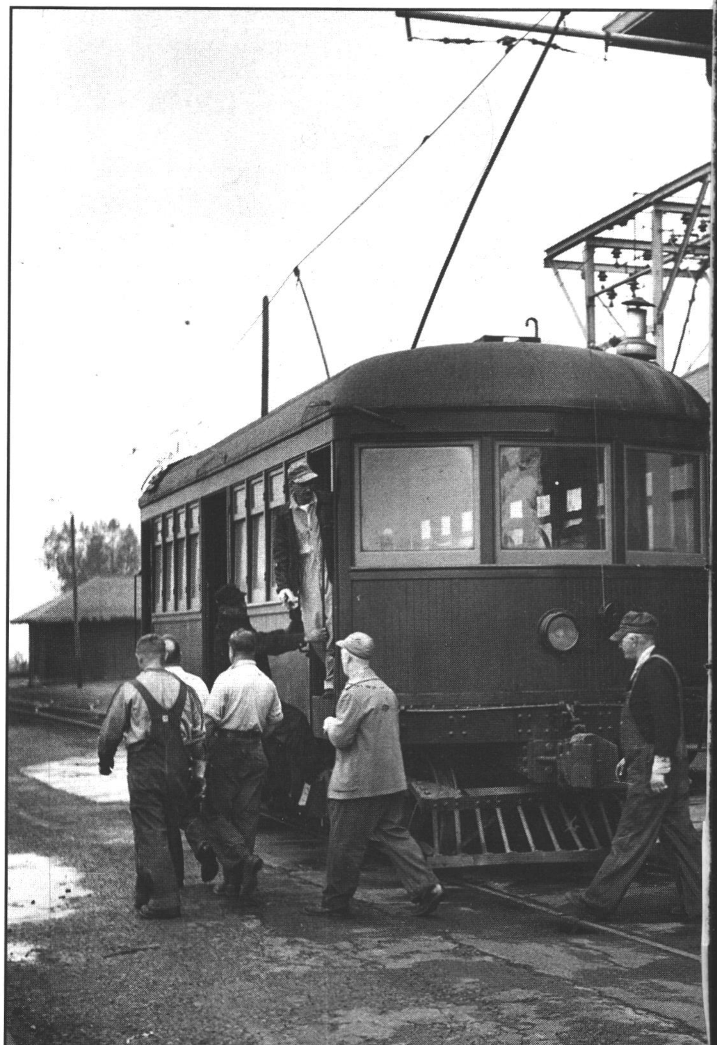
map from *Electric Railways of Minnesota*



The single track carbarn. Russ Olson photo, MTM collection.

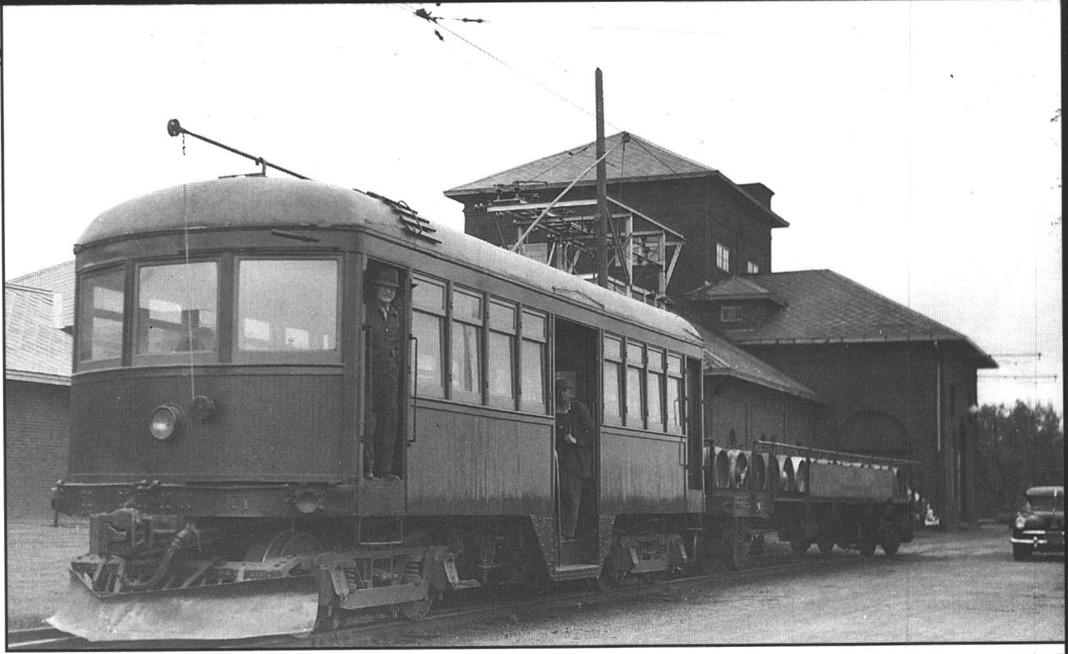


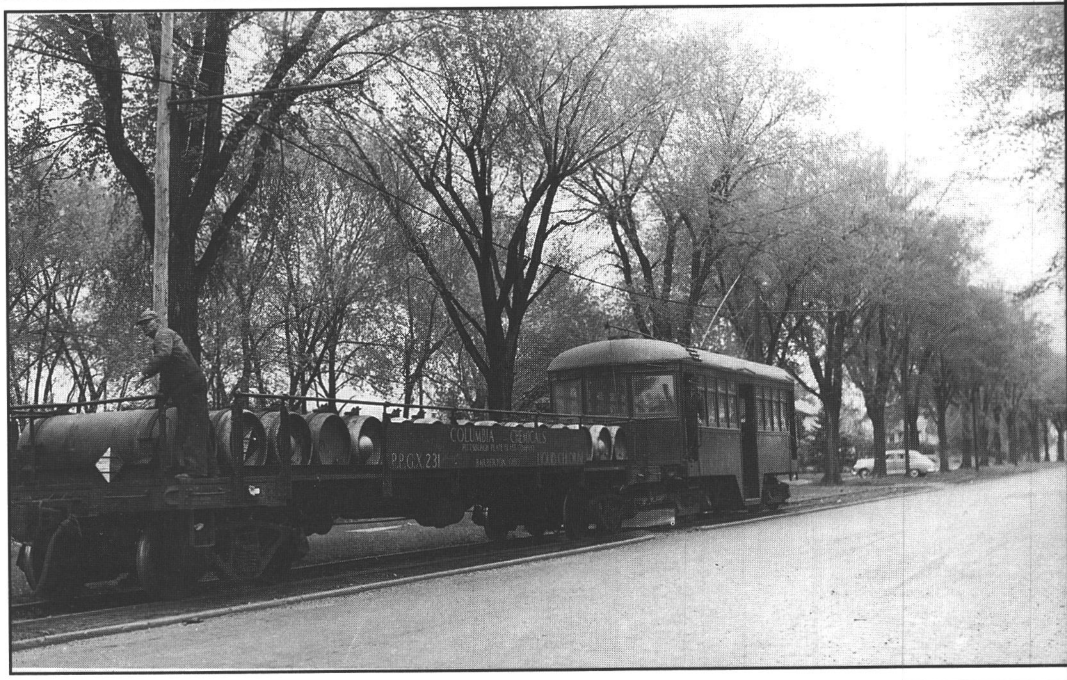
Below: Everyone climbs aboard for the last trip on May 18, 1953 at the Filtration Plant.
Minneapolis Star-Tribune photo, Star-Tribune collection.



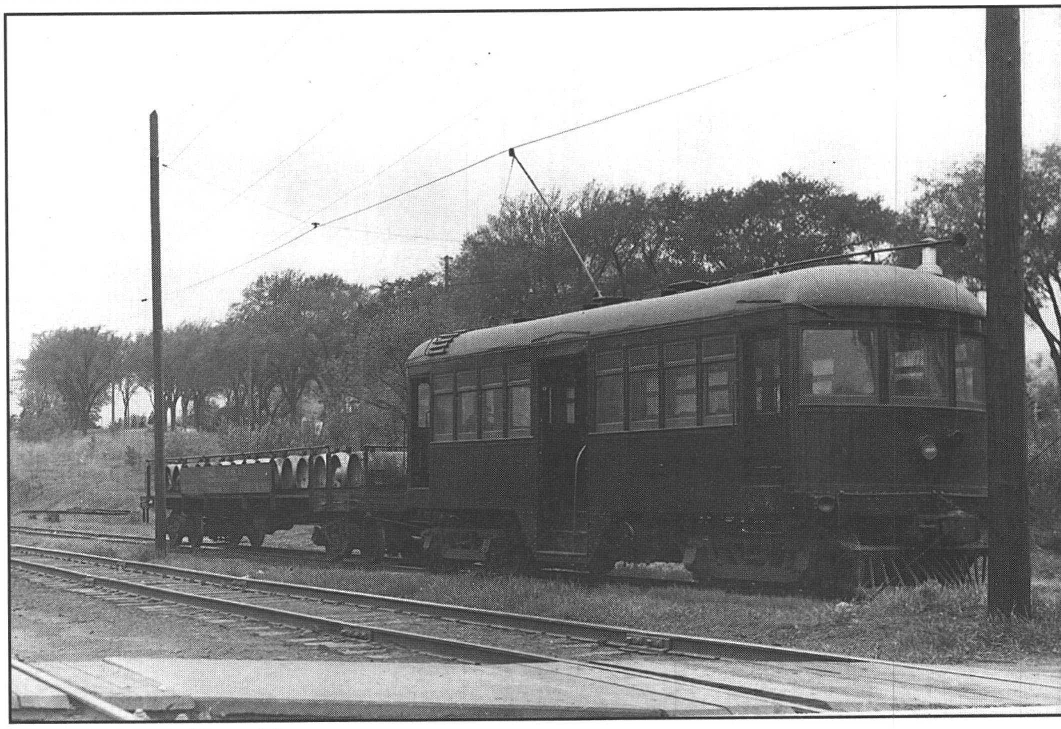
cents. In 1927 the line carried 14,600 employees and 5681 paying passengers. Passenger service lasted until 1948.

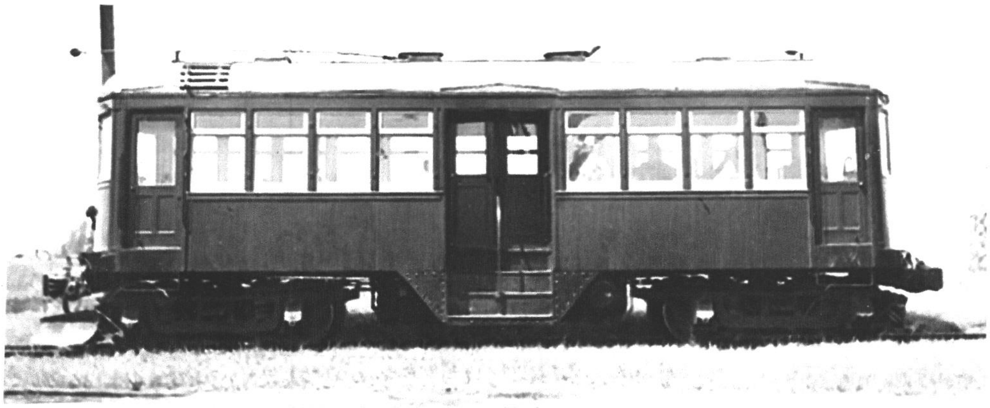
When #1 needed heavy maintenance, it would travel to Snelling Shops. This required derailing it at the crossing with the streetcar line, since there was no switch. During these times TCRT would loan one of its handful of double ended shuttle cars and the Soo Line would send a steam engine up to the plant. The line had a single motorman, Myron Handy, from its opening in 1917 until 1952. He didn't miss the end of service by very much. Dependent as it was on TCRT, the Filtration Plant line closed in May 1953, three months after the abandonment of the Central Avenue line. *The facts in this article were taken from Electric Railways of Minnesota, by* ***Russ Olson.***

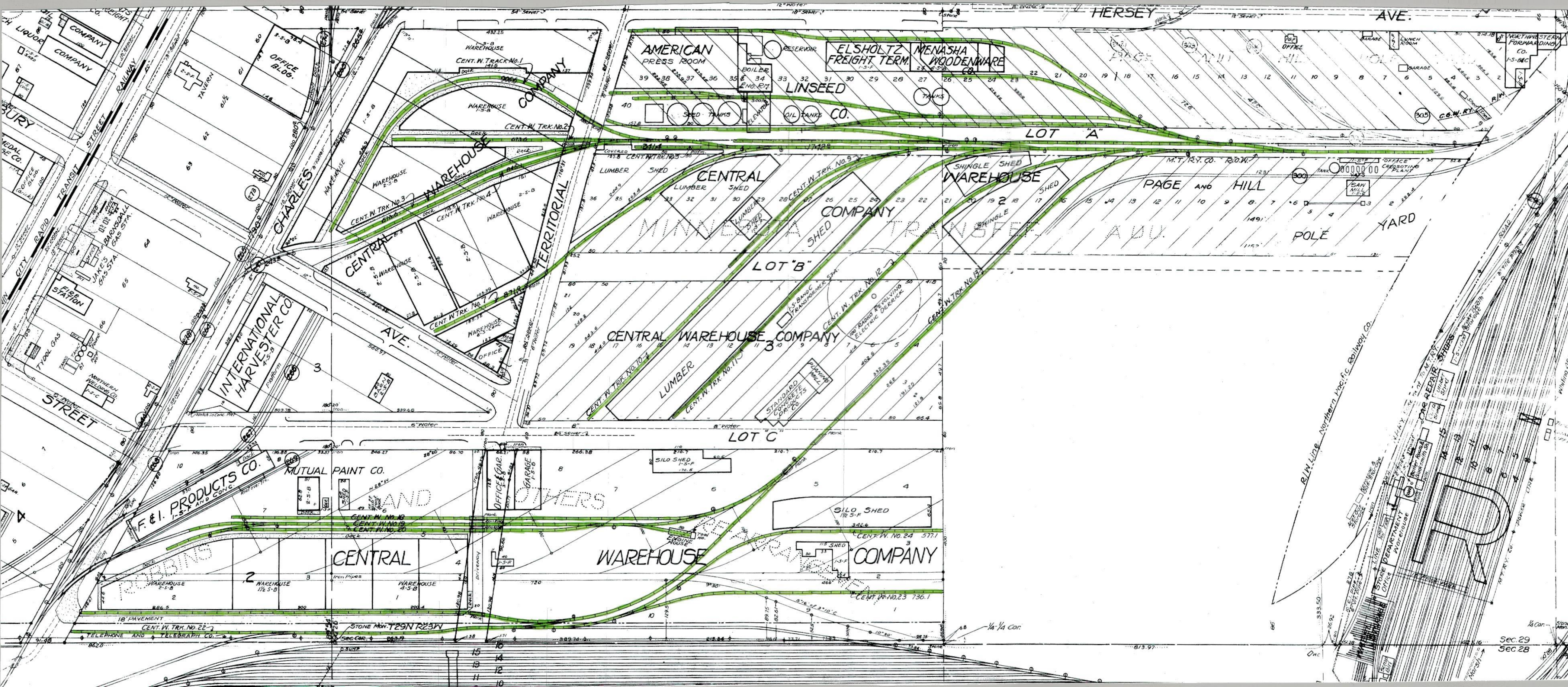




Left: Photographer Herman Rinke followed this movement of empty chlorine bottles to the Soo Line interchange on May 17, 1951.






HERSEY AVE.
CHARLES AVE.
TERRITORIAL
STREET
CITY RAPID TRANSIT RAILWAY
LIQUOR COMPANY
OFFICE BLDG.
TAVERN
FIRE STATION
JAKE'S GAS STA.
PARNSDALL GAS STA.
TYDOL GAS
NORTHERN WELDING CO.
INTERNATIONAL HARVESTER CO.
AMERICAN PRESS ROOM
BOILER
ENG. RM.
RESERVOIR
ELSHOLTZ FREIGHT TERM.
MENASHA WOODENWARE CO.
LINSEED CO.
SEED TANKS
ELEVATOR
OIL TANKS
TANKS
NORTHWESTERN FORWARDING CO.
OFFICE
LUNCH ROOM
GARAGE
LOT "A"
C.G.W. RY.
M.T. RY. CO. R.O.W.
CENTRAL WAREHOUSE COMPANY
WAREHOUSE
CENT. W. TRACK No. 1
CENT. W. TRK. No. 2
CENT. W. TRK. No. 3
CENT. W. TRK. No. 4
CENT. W. TRK. No. 5
CENT. W. TRK. No. 9
CENT. W. TRK. No. 10
CENT. W. TRK. No. 11
CENT. W. TRK. No. 12
CENT. W. TRK. No. 13
LUMBER SHED
CENTRAL LUMBER SHED
SHINGLE SHED
SHINGLE SHED
WAREHOUSE
OFFICE CREOSOTING PLANT
SAW MILL
PAGE AND HILL POLE YARD
MINNESOTA TRANSFER ADD.
LOT "B"
COMPANY
CENTRAL WAREHOUSE COMPANY
LUMBER
I.S. BANG'C TRANSFORMER STA.
100' RADIUS REVOLVING ELECTRIC DERRICK
STANDARD CONCRETE PRODUCTS CO.
PLANING MILL
OFFICE
LOT "C"
MUTUAL PAINT CO.
F. & I. PRODUCTS CO.
SILO SHED
OFFICE & GAR.
GARAGE
CENT. W. No. 18
CENT. W. No. 19
CENT. W. No. 20
CENT. W. No. 24
CENT. W. No. 23
CENT. W. TRK. No. 22
ENGINE HOUSE
CENTRAL WAREHOUSE COMPANY
ROBBINS AND OTHERS
REARRANGEMENT
18' PAVEMENT
TELEPHONE AND TELEGRAPH CO.
STONE MON. T29N R23W
Sec. Cor.
1/4-1/4 Cor.
1/4 Cor.
Sec. 29
Sec. 28
R/W Line Northern Pacific Railway Co.
CAR REPAIR SHOPS
STORE DEPARTMENT
M.T. RY. CO.
6" Water
8" Water
12" Water
18" Sewer
24" Sewer
Iron
Plank

CENTRAL WAREHOUSE COMPANY

St.PAUL, MINNESOTA

This company constructed a large warehousing facility involving numerous buildings in the Midway district of St.Paul west of the Minnesota Transfer Railway yards. Services provided included cold storage, merchandise storage, pool car distribution, and local cartage. Approximately 2.75 miles of industrial sidings were owned by the company over which switching was performed by the Minnesota Transfer Railway. The president of Central Warehouse Company in 1916 was Charles P. Bratnober, who was also the president of the Minneapolis, Anoka & Cuyuna Range Railway and receiver of the Minneapolis, St.Paul, Rochester & Dubuque Electric Traction Company (Dan Patch Electric Lines).

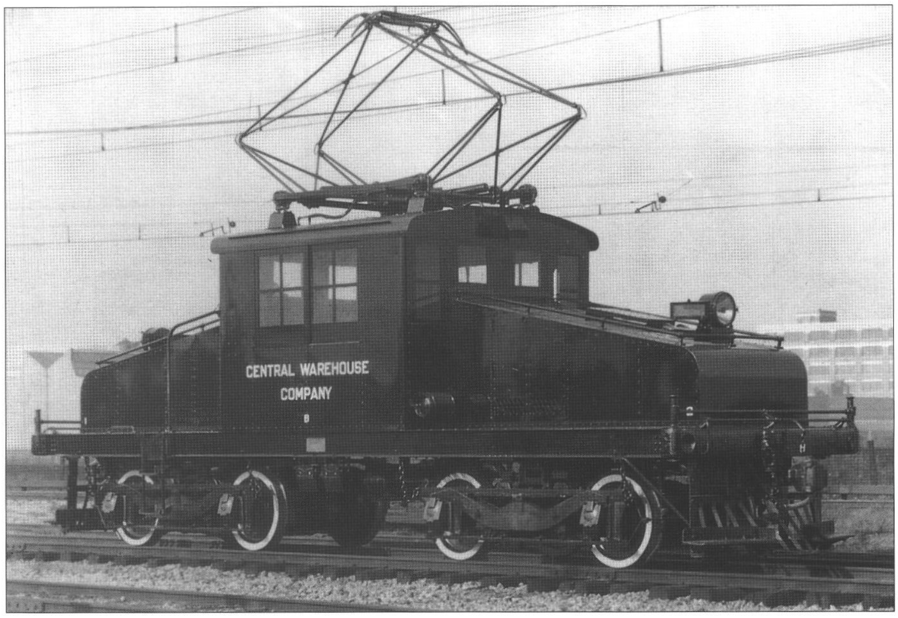
Presumably through Mr. Bratnober's efforts, Central Warehouse Company acquired Dan Patch Electric Lines' pioneer gasoline-electric freight locomotive 100 in 1917 for use in performing its own switching over its industrial sidings. In 1918 a decision was made to electrify all of the industrial trackage. $35,000 was spent for erection of catenary overhead and construction of power facilities. Power was purchased from Northern States Power Company at 4,100 volts A.C. and converted to 600 volts D.C. An additional $28,000 was spent on purchasing a new steeple-cab electric locomotive as well as converting 100 to straight electric operation.

The new electric locomotive was purchased from the General Electric Company, builder's serial number 7597 built in September 1919. Particulars are: Class 404E100, Alco RM-63B trucks, four G.E. 257A motors of 145 h.p. each, Type M multiple-unit control with one C-90-A master controller, and pantograph for current collection.

In 1922 the ex Dan Patch Electric Lines locomotive 100 was sold to the Minneapolis, Anoka & Cuyuna Range Railway.

In 1951 the decision was made to discontinue the electrification and replace the electric locomotive with a General Electric Company 44-ton diesel-electric locomotive. Upon arrival of the new locomotive the overhead was dismantled. On June 20, 1951, the electric locomotive was sold to a business in St.Louis, Missouri, for use in South America.

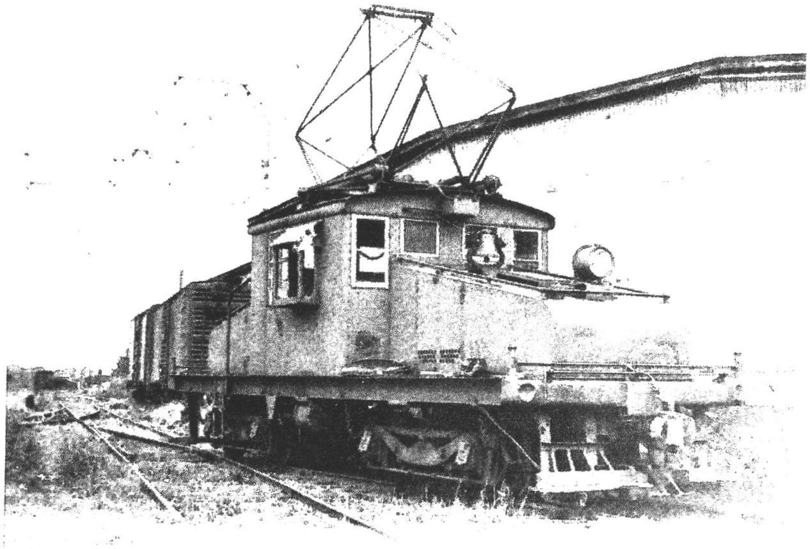
As of 1976 the Central Warehouse continued in business actively using the same G.E. 44-ton diesel-electric locomotive. It should be noted that at that time the company had operated only General Electric Company locomotives: gasoline-electric, straight electric, and diesel-electric.



By November 1919, World War I was over and the Erie works had the time to paint and properly pose locomotives before shipping them out. The GE photographer captured fifty-ton #7597 on a sunny November 17, 1919, complete with white-striped tires, the day before it was waybilled out to the Central Warehouse Company in St. Paul, Minnesota. It would serve that switching service until 1951, when a new GE 44-ton diesel supplanted it.

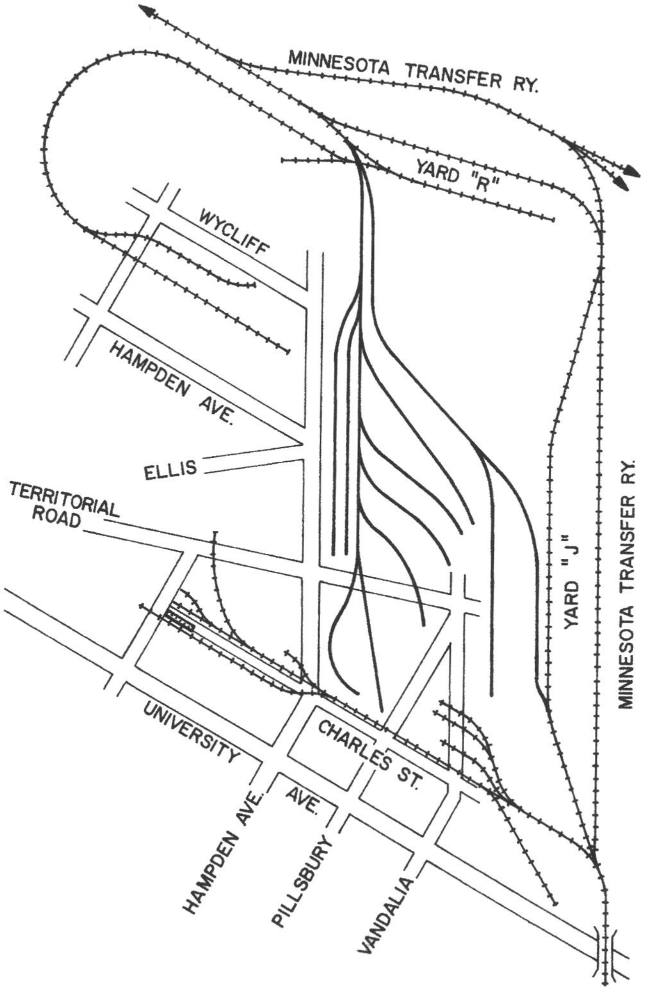
(GE: Corley collection)

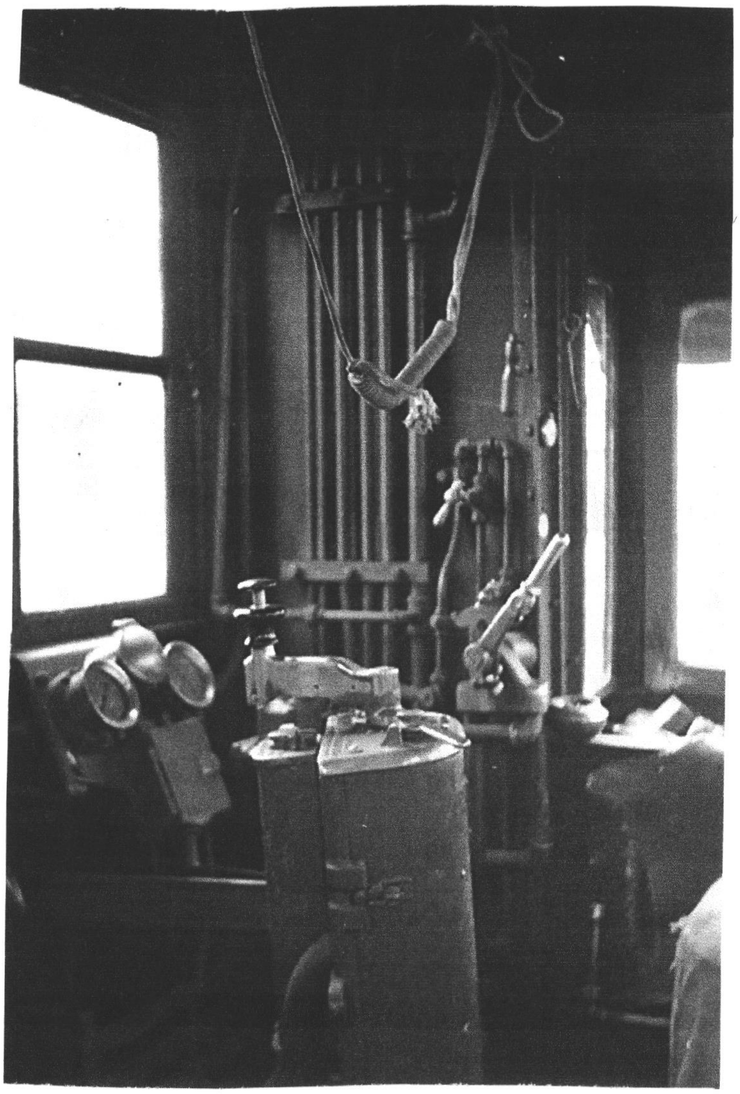
BUILDERS DATE 11-17-1919
50 TON 65:16 GEAR RATIO



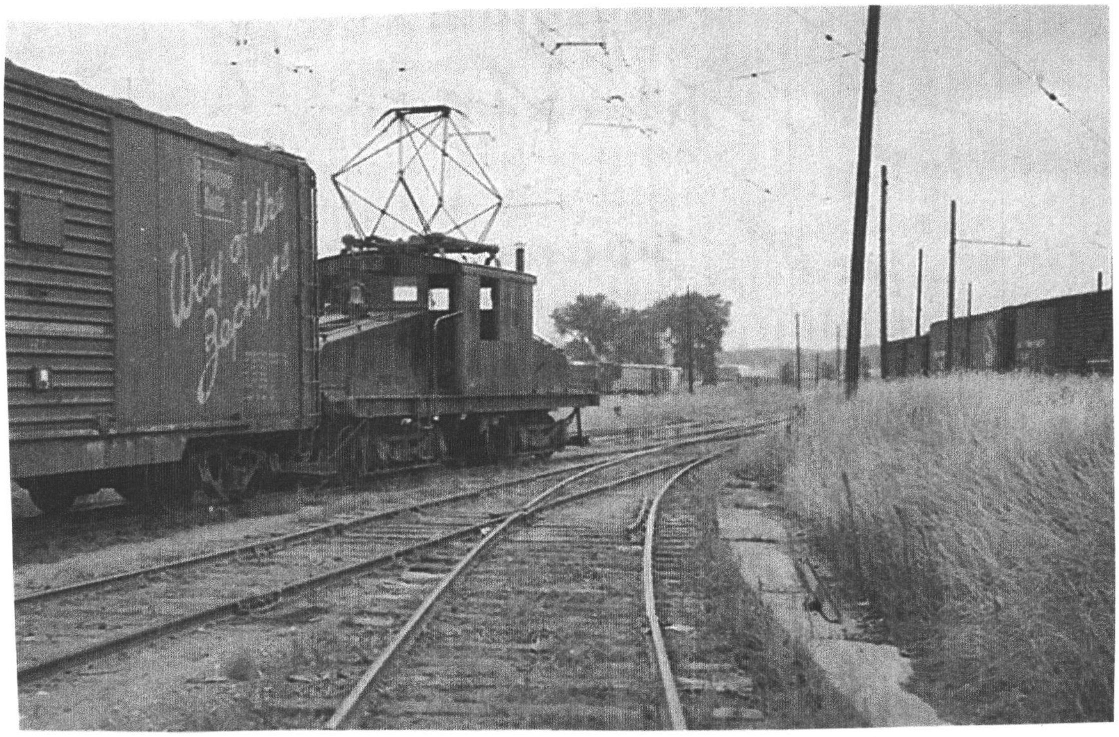
The electric locomotive switching on a typical section of warehouse trackage. Note the catenary overhead. (Norman F. Podas)

CENTRAL WAREHOUSE CO.
ST. PAUL, MINNESOTA 1954

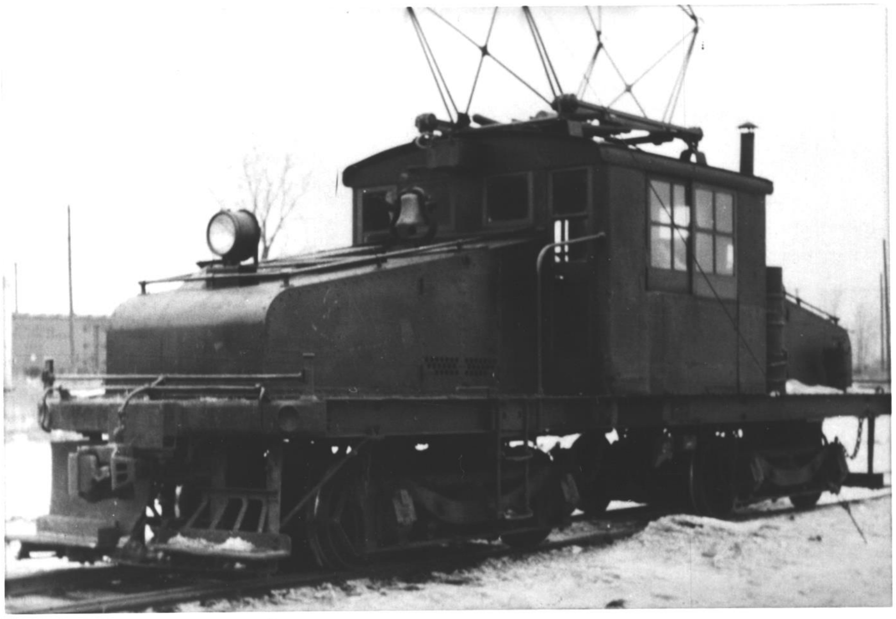

MINNESOTA TRANSFER RY.
YARD "R"
WYCLIFF
HAMPDEN AVE.
ELLIS
TERRITORIAL ROAD
YARD "J"
MINNESOTA TRANSFER RY.
UNIVERSITY AVE.
CHARLES ST.
HAMPDEN AVE.
PILLSBURY
VANDALIA



Office DEPOT®


Burlington Route
Way of the Zephyrs

• DEC • 73



1

IRON ORE MINING RAILWAYS

INTRODUCTION

All of the mines involved were of the open pit type so the railroad operations were essentially similar. Stripping tracks were first laid to facilitate removal of the topsoil and overburden when opening or expanding a pit. Dump tracks were constructed to the site(s) where unsuitable materials were deposited. Approach tracks from the main line to the floor of the pit were built next, and then the connecting temporary loading tracks in the pit itself. As the pit was worked, the loading tracks were constantly being shifted and relocated. Iron ore was loaded into air-operated side-dump cars by power shovels and hauled to washing/screening plants. From there the ore was hauled to beneficiating or concentrating plants if the quality of the ore required this further processing. The ore was then hauled by steam railroad from either the screening plants or beneficiating plants to the docks on Lake Superior for loading into boats for transporting to the steel mills.

For ease in loading the side-dump cars with power shovels, the trolley wire was offset to one side of the track so the electric locomotives were equipped with side-arm power collectors. The main line trackage was usually constructed with trolley wire over the center line of the track so the locomotives were also equipped with pantographs.

Since many of the stripping, dumping and loading tracks were temporary, they were not often electrified. The locomotives were equipped with a reel of power cable mounted on the hoods. At the end of the trolley wire the last overhead line pole was fitted with a special switch and a hook connected to the power source. Each locomotive cable had a ring fastened to the end; the cable was wrapped several times around the pole and ring slipped over the hook. The power was turned on and the locomotive could move at will on the non-electrified trackage, the reel automatically un-reeling or reeling-in cable as needed.

The first large off-highway dump trucks were acquired by these companies in 1939-1940. They took over the hauling of the iron ore from the pit to the washing/screening plants resulting in the removal of trackage in the pit itself. This drastically reduced the track mileage operated and simplified the remaining railroad operations.

HANNA ORE MINING COMPANY

Wabigon Mine
Buhl, Minnesota

This mine, located just north of Buhl, was first opened in 1924. It was operated by the Hanna company until 1930 when the mine was closed. An electric railroad was constructed during 1924. Three electric locomotives, 301-303, were purchased from the General Electric Company and received in August 1924. Each locomotive was equipped with two side-arm collectors and one pantograph. Air-operated side-dump cars (numbered in the 200 series), usually five cars per train, were used. A map of the railroad has not been located so the extent of electrification cannot be determined. Upon closing of the mine in 1930 the three locomotives and most of the other railroad equipment ~~was~~ were transferred to the Mesabi Chief Mine at Keewatin.

The mine was re-opened in 1941 and worked form 1941 through 1948. Stockpile shipments were made from 1949 through 1952. Apparently this operation was handled by conventional railroad equipment.

Mesabi Chief Mine
Keewatin, Minnesota

This mine was first opened in 1913 and operated for only a short time during 1913. In 1928 the mine was re-opened and large-scale mining operations begun. The electric railroad was completed in 1928. In addition to the pit trackage a main line ran from the pit to the beneficiating plant, located on the Great Northern Railway, a distance of approximately 1.75 miles. Some of the rail used in construction of the line came from the recently abandoned Mesaba Railway.

Four electric locomotives were ordered from the General Electric Company in July 1928 and delivered in September. Numbered 304-307 they were builder's shop numbers 10603-10606 respectively, Class B-B-120/120 4HM 833B-600. Weight was 60 tons. Cost f.o.b. factory was $25,000 each. Each was equipped with two side-arm current collectors. All trolley wire was offset to eliminate the use of pantographs. Twenty-two Differential Steel Company air-operated side-dump cars (numbered in the 500 series), 30 cubic yard capacity, were purchased.

Alternating Current was purchased and converted to 600 volts Direct Current by means of step-down transformers and a motor-generator set.

When the first Euclid off-highway dump trucks were purchased in 1939-1940 a washing/screening plant was built in the pit. Trucks hauled the ore from the loading shovel to this plant. The processed ore was moved by conveyor belt to loading bins at the pit edge and then loaded into the side-dump cars for the rail haul to the beneficiating plant. Two trains were operated at one time, one loading and the other unloading. Each train consisted of one locomotive and five dump cars with a total capacity of 300 tons of ore. A passing track was located about halfway between the pit and the beneficiating plant.

The three electric locomotives, 301-303, transferred from the Wabigon Mine were eventually sold to the Mesaba-Cliffs Mining Company at Marble, Minnesota.

The Mesabi Chief Mine was closed at the end of the 1968 ore mining season. The electric railroad was dismantled during November and December 1968. Sixteen of the side-dump cars were sold to the Mesaba-Cliffs Mining Co. The electric locomotives were donated for display purposes.

304	City Park, Keewatin
305	Minnesota Musuem of Mining, Chisholm
306	Hill Annex Mine State Park, Calumet
307	Lake Superior Museum of Transportation, Duluth

INTER-STATE IRON COMPANY
Hill Annex Mine
Calumet, Minnesota

The Inter-State Iron Company became a subsidiary of Jones & Laughlin Steel Corporation and operated a number of mines at various locations on the Mesabi Range. The Hill-Annex Mine was opened in 1917 and was still in operation in the early 1970's. They decided to electrify their mining railroad at the Hill-Annex Mine; 22 miles of catenary overhead wire were erected during 1930.

Eight electric locomotives were purchased from the General Electric Company in 1930. numbered 201-208 they were builder's shop numbers 11383-11390 respectively. Particulars are: 37'6" long, 8'10" wide, 14'10" high, weight 85 tons, General Electric trucks, 46" wheels, four G.E. 818A2 motors of 250 h.p. each, and Type M multiple-unit control. Side-arm current collectors with a small pantograph were installed on each locomotive.

In January 1937 Duluth Street Railway Work Car 1/64 was acquired. It came equipped with Twin City Work Car trucks, four G.E. 70 motors, and two K-6 controllers.

Two electric locomotives were acquired in 1942 from the Southern Pacific Railroad. Both had been built for the Portland, Eugene & Eastern Railway and later acquired by the Southern Pacific as their 101-102. Data on both locomotives: 32'2" long, 10'1" wide, 12'0" high, weight 125,500 pounds, Baldwin trucks, 36" wheels, four Westinghouse 308D3 motors of 240 h.p. each, and Westinghouse HL control.

209 (ex 102) Baldwin-Westinghouse, builder's number 38298, Class D, built September 1912.
210 (ex 101) Baldwin-Westinghouse, builder's number 38154, Class D, built August 1912.

In 1944 the Waterloo, Cedar Falls & Northern Railway purchased 209-210 through the Iron and Steel Products Company, Chicago. 209 became their 187 while 210 became their 186. (Both were sold by the WCF&N RR to the B. Schultz Co. for scrap August 1, 1957.)

During 1947 locomotives 207-208 were sold to the Waterloo, Cedar Falls & Northern Railway which retained the original numbers.

Apparently the electrification was discontinued in 1955. On December 31, 1955, locomotives 201-203 were photographed in Superior, Wisconsin, in transit to an unknown destination. Locomotives 204-206 were sold to the Mesaba-Cliffs Mining Co., Marble, Minnesota.

MESABA-CLIFFS MINING COMPANY
Hill-Trumbull Mine
Marble, Minnesota

The Mesaba-Cliffs Mining Company is owned by the Cleveland-Cliffs Iron Company. The Hill Mine was operated by the Oliver Iron Mining Company from 1910-1916; the Mesaba-Cliffs Mining Co. began operations there in 1920. The Trumbull Mine was opened by the Mesaba-Cliffs Mining Co. in 1920. Either at this time or at some later date the operations of the two mines were combined as the Hill-Trumbull Mine. This operation continued through the 1970's.

The date electric operation of the railroad began is unknown. Three electric locomotives (301-303, General Electric Co., 1924) were purchased from the Hanna Ore Mining Co. that had been used in the Wabigon Mine at Buhl. Alternating Current was purchased and converted to 600 volts Direct Current by means of a motor-generator set.

Twenty air-operated side-dump cars of 30 cubic yard capacity each, built by the Western Wheeled Scraper Company were owned. Trains consisted of from five to seven dump cars each for a total capacity of 300 to 420 tons per train.

Locomotives 301-303 were sold to the Chilean Nitrate Company in 1955. They were replaced by the acquisition of locomotives 204-206 (General Electric Co., 1930) from the Inter-State Iron Co. These were used until the end of electric operations. In 1968 sixteen side-dump cars were acquired from the Hanna Ore Mining Co.'s recently abandoned electric railroad at the Mesabi Chief Mine. During 1969 twelve of Mesaba-Cliffs Mining Co.'s original side-dump cars were scrapped.

The electric railroad continued in operation until 1972, running from the pit to the concentrator plant, a distance of about 1.75 miles. Side-arm current collectors together with the small pantograph were used.

OLIVER IRON MINING COMPANY
Virginia and Hibbing, Minnesota

This company had at least two very short standard gauge electric railroads about which little is known.

A crushing plant was built during 1924 near the Rainy Junction Yard of the Duluth, Missabe & Northern Railway south of Virginia. This was called the Virginia Crusher and is now (1972) known as the Rouchleau Crusher. An electric haulage railroad was simultaneously built for the purpose of moving lean ore and reject rock to a nearby mine dump. A small four-wheel, 35-ton, pantograph-equipped steeple-cab electric locomotive, numbered 2000, and two air-operated side-dump cars were operated over about one-half mile of track. Because of operational changes in the crushing operation the electric railroad was little used and the locomotive eventually transferred to the Hull-Rust Crusher at Hibbing.

The Hull-Rust Crusher (also known as the Kerr Crusher) at Hibbing had a similar electric railroad moving reject rock from the lower side of the crushing plant about one-fourth mile to the south. Electric locomotive number 2001, identical to number 2000, was operated at this location and was eventually joined by number 2000. A photograph shows both of them equipped with side-arm trolleys; the offset overhead trolley wire was supported by portable wood support poles. (These portable poles were usually used for tracks on the pit floor which were constantly being relocated.) The Hull-Rust operation was closed in the late 1960's, the crushing plant dismantled, and the two locomotives presumably scrapped.

Additional Information on Electric Locomotives
HM = Hoist & Mining

Hanna Ore Mining Co.

301-303: Builder numbers 9514-9516, HM840 motors, weight 60 tons.
304-307: 304-306 built September 1928; 307 built October 1928. HM 833B motors. Radical new truck equalization system (not articulated).

Inter-State Iron Company

Used articulated trucks which had the greatest success on temporary track with constant changes in grade and alignment (open pit mining).
201-206: built 1930, weight 75 tons.
207-208: built January 1931, weight 83 tons. Sold April 1947 to WCF&N Ry.; in service 5-7-1947 and 4-23-1947 respectively. Sold for scrap 8-1-1957 to B. Schultz Scrap Metal Co.; scrapped July 1960.
209-210: built 1912 for Oregon & California Railroad 201-202. July 1915 Portland, Eugene & Eastern Railroad 101-102. (SP RR subsidiaries.) December 1916 Southern Pacific Railroad 101-102.

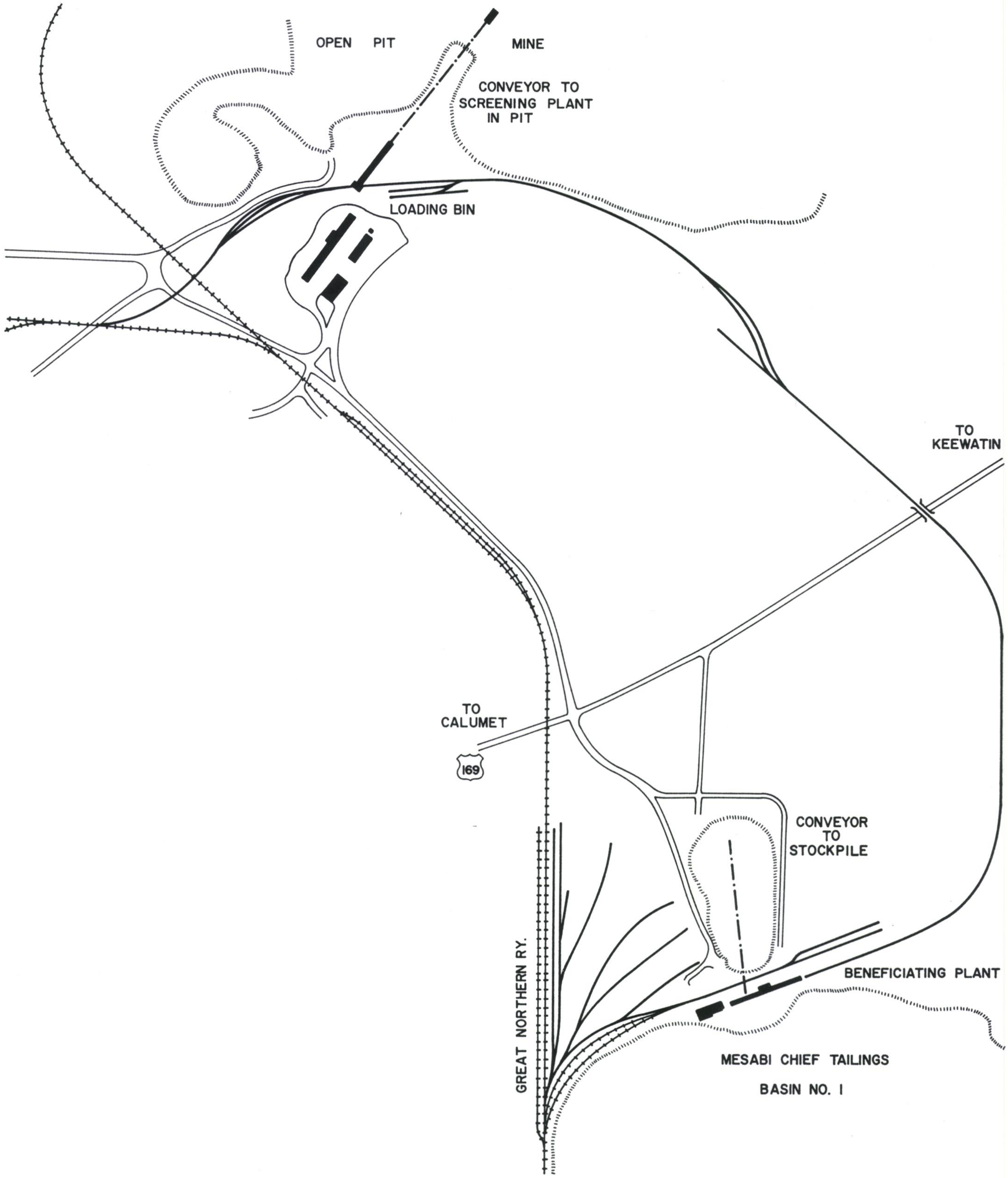
101: sn 38154, BLW 8-9-1912/WH 12-31-1912. Model D. 4 WH 308D3 motors (1,116 h.p.). Weight 62 tons.

102: sn 38298, BLW 9-6-1912/WH 1-15-1913. Model D. 4 WH 308D3 motors (1,116 h.p.). Weight 62 tons. Sold 11-20-1941 to Iron & Steel Products Co., Chicago (dealer); resold 1942 to Inter-State Iron Co. as their 210 and 209 respectively. Sold 1944 to WCF&N Ry. as their 187 and 186 respectively. Sold for scrap 8-1-1957 to B. Schultz Scrap Metal Co.

[101 became 210 became 186; 102 became 209 became 187]

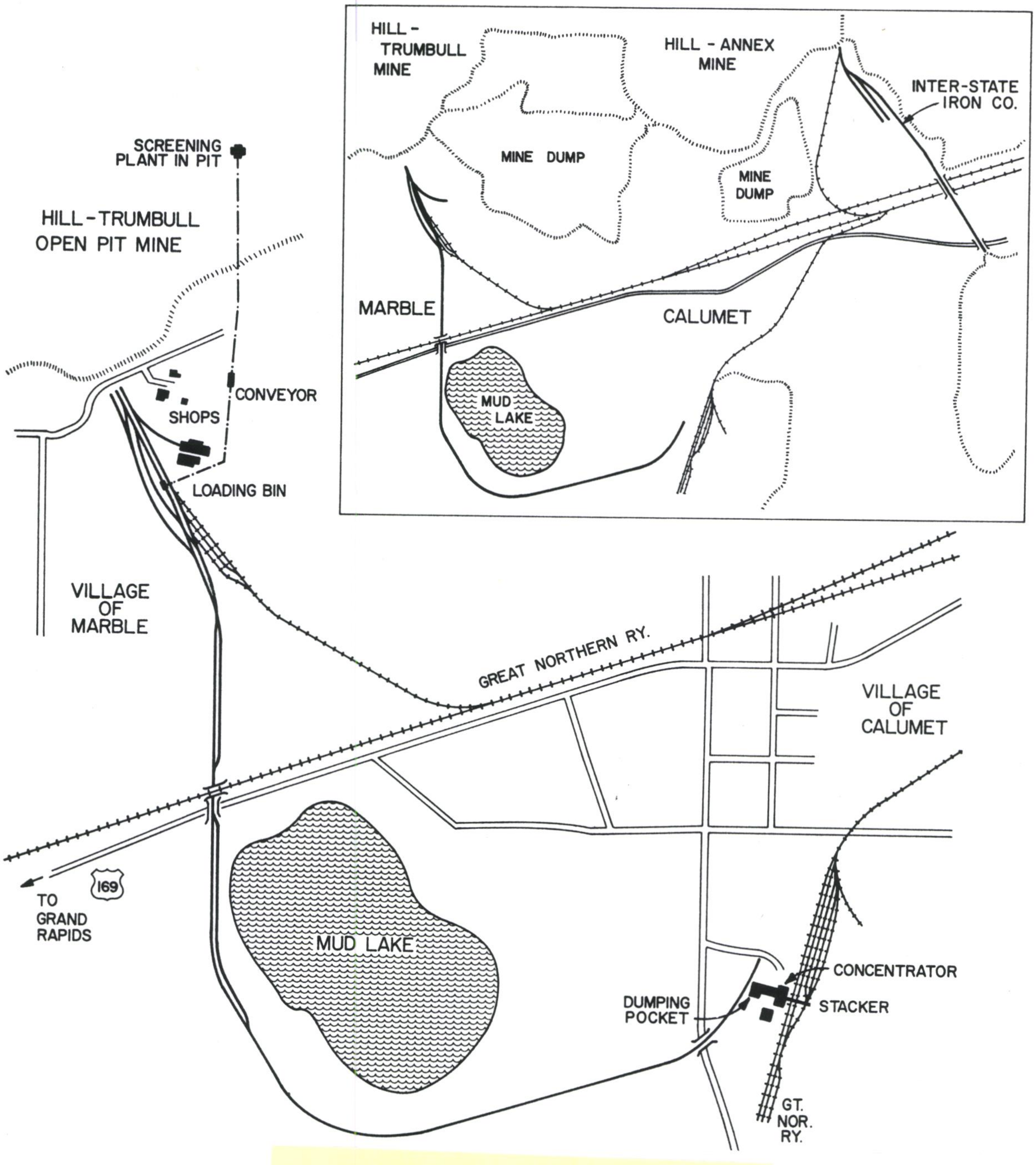
HANNA ORE MINING CO.

MESABI CHIEF MINE, KEEWATIN, MINN.

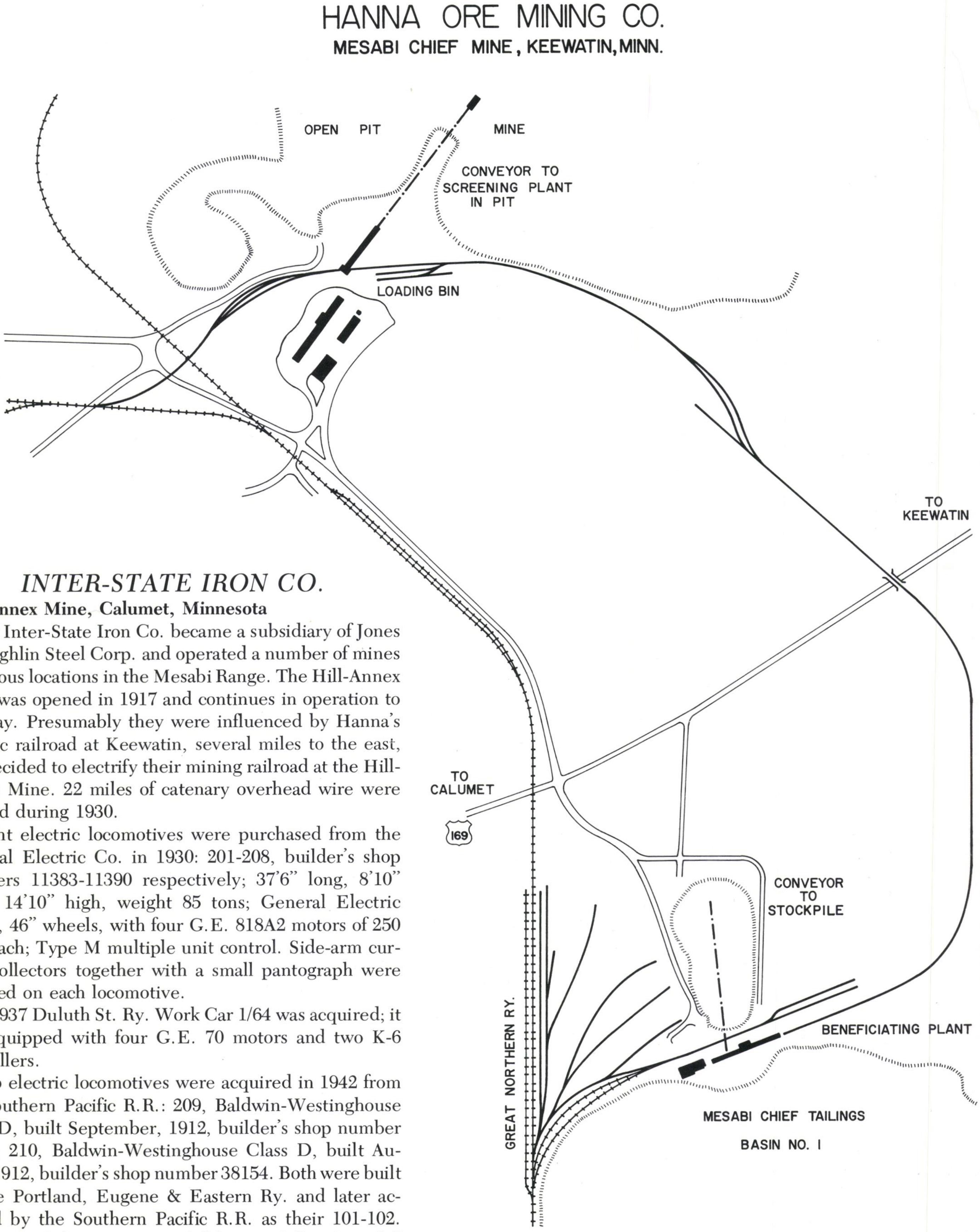

OPEN PIT
MINE
CONVEYOR TO SCREENING PLANT IN PIT
LOADING BIN
TO KEEWATIN
TO CALUMET
169
CONVEYOR TO STOCKPILE
BENEFICIATING PLANT
MESABI CHIEF TAILINGS
BASIN NO. 1
GREAT NORTHERN RY.

MESABA-CLIFFS MINING CO.

MARBLE, MINNESOTA


HILL-TRUMBULL MINE
HILL - ANNEX MINE
INTER-STATE IRON CO.
MINE DUMP
MINE DUMP
MARBLE
CALUMET
MUD LAKE
SCREENING PLANT IN PIT
HILL-TRUMBULL OPEN PIT MINE
CONVEYOR
SHOPS
LOADING BIN
VILLAGE OF MARBLE
GREAT NORTHERN RY.
VILLAGE OF CALUMET
169
TO GRAND RAPIDS
MUD LAKE
CONCENTRATOR
STACKER
DUMPING POCKET
GT. NOR. RY.

Inter State Iron Co.
August 1930 Railway Age:
Had ordered 42 Air Dump Cars
from Koppel Industrial Car &
Equipment Co.


HANNA ORE MINING CO.
MESABI CHIEF MINE, KEEWATIN, MINN.
OPEN PIT MINE
CONVEYOR TO SCREENING PLANT IN PIT
LOADING BIN
TO KEEWATIN
TO CALUMET
169
CONVEYOR TO STOCKPILE
BENEFICIATING PLANT
GREAT NORTHERN RY.
MESABI CHIEF TAILINGS BASIN NO. I

INTER-STATE IRON CO.

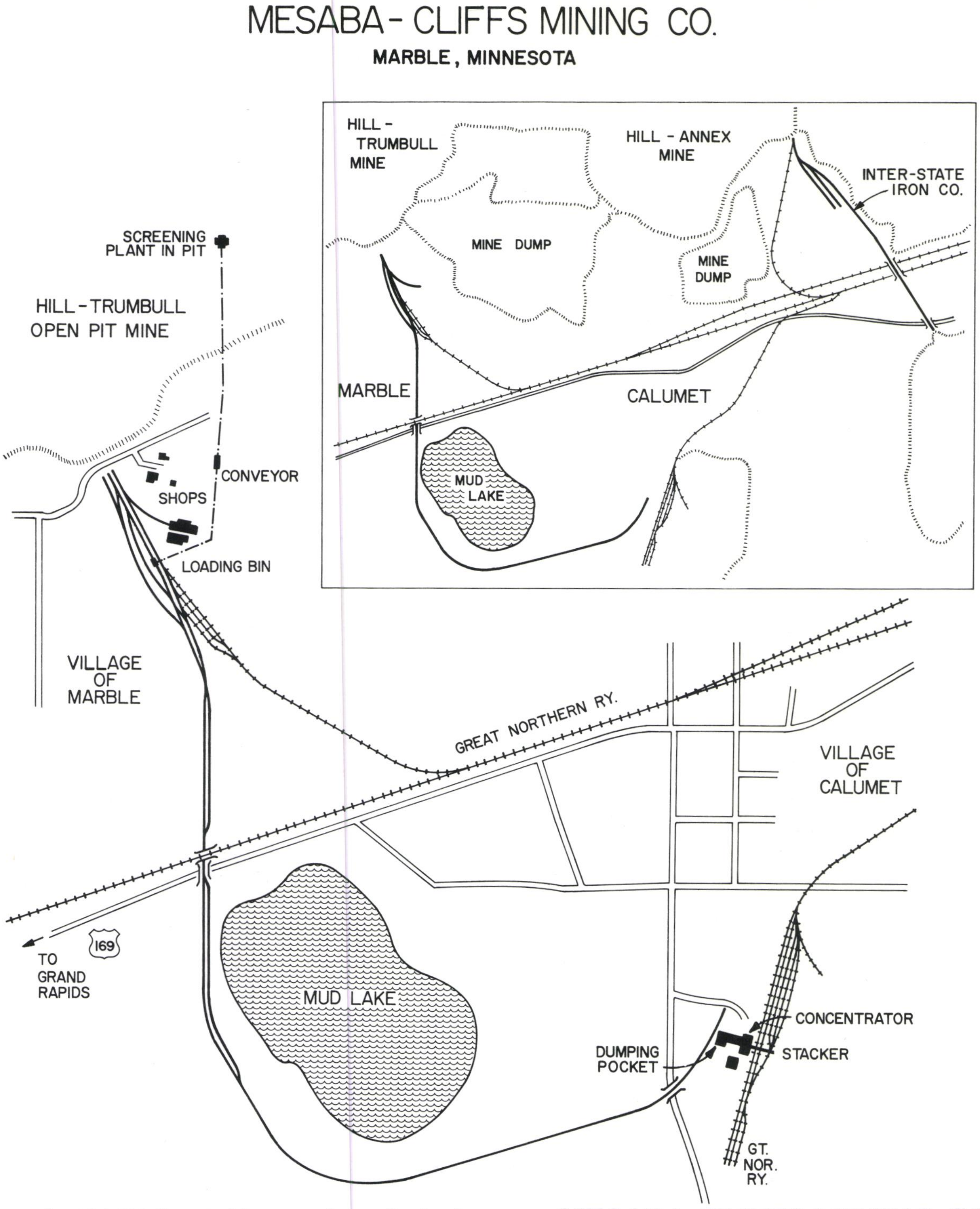
Hill-Annex Mine, Calumet, Minnesota

The Inter-State Iron Co. became a subsidiary of Jones & Laughlin Steel Corp. and operated a number of mines at various locations in the Mesabi Range. The Hill-Annex Mine was opened in 1917 and continues in operation to this day. Presumably they were influenced by Hanna's electric railroad at Keewatin, several miles to the east, and decided to electrify their mining railroad at the Hill-Annex Mine. 22 miles of catenary overhead wire were erected during 1930.

Eight electric locomotives were purchased from the General Electric Co. in 1930: 201-208, builder's shop numbers 11383-11390 respectively; 37'6" long, 8'10" wide, 14'10" high, weight 85 tons; General Electric trucks, 46" wheels, with four G.E. 818A2 motors of 250 h.p. each; Type M multiple unit control. Side-arm current collectors together with a small pantograph were installed on each locomotive.

In 1937 Duluth St. Ry. Work Car 1/64 was acquired; it was equipped with four G.E. 70 motors and two K-6 controllers.

Two electric locomotives were acquired in 1942 from the Southern Pacific R.R.: 209, Baldwin-Westinghouse Class D, built September, 1912, builder's shop number 38298; 210, Baldwin-Westinghouse Class D, built August, 1912, builder's shop number 38154. Both were built for the Portland, Eugene & Eastern Ry. and later acquired by the Southern Pacific R.R. as their 101-102. Data on both locomotives: 32'2" long, 10'1" wide, 12'0"


MESABA-CLIFFS MINING CO.
MARBLE, MINNESOTA
HILL-TRUMBULL MINE
HILL-ANNEX MINE
INTER-STATE IRON CO.
MINE DUMP
MINE DUMP
MARBLE
CALUMET
MUD LAKE
SCREENING PLANT IN PIT
HILL-TRUMBULL OPEN PIT MINE
CONVEYOR
SHOPS
LOADING BIN
VILLAGE OF MARBLE
GREAT NORTHERN RY.
VILLAGE OF CALUMET
169
TO GRAND RAPIDS
MUD LAKE
CONCENTRATOR
STACKER
DUMPING POCKET
GT. NOR. RY.

high, weight 125,500 lbs.; Baldwin trucks, 36" wheels, with four Westinghouse 308D3 motors of 240 h.p. each; Westinghouse HL control.

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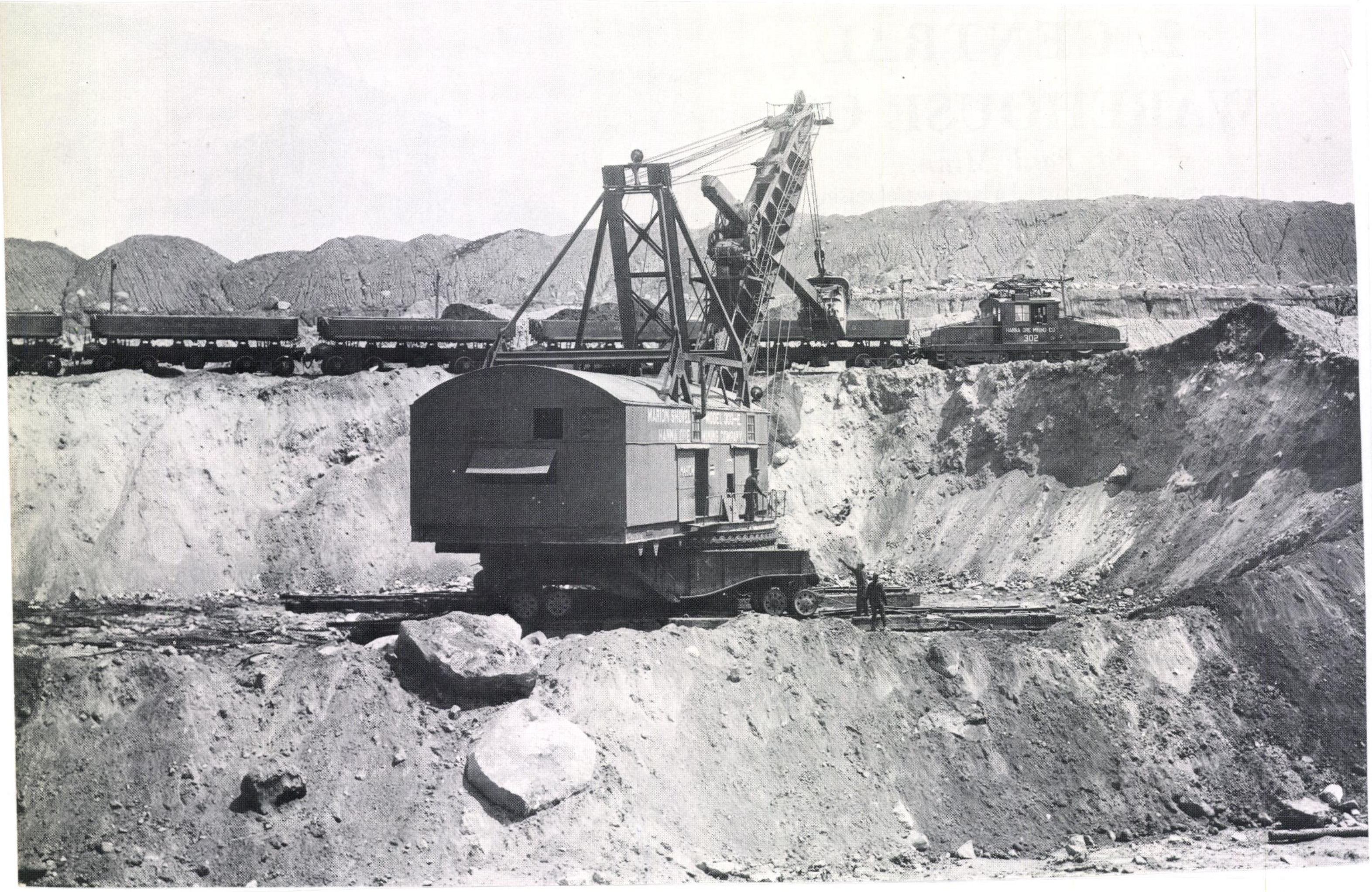
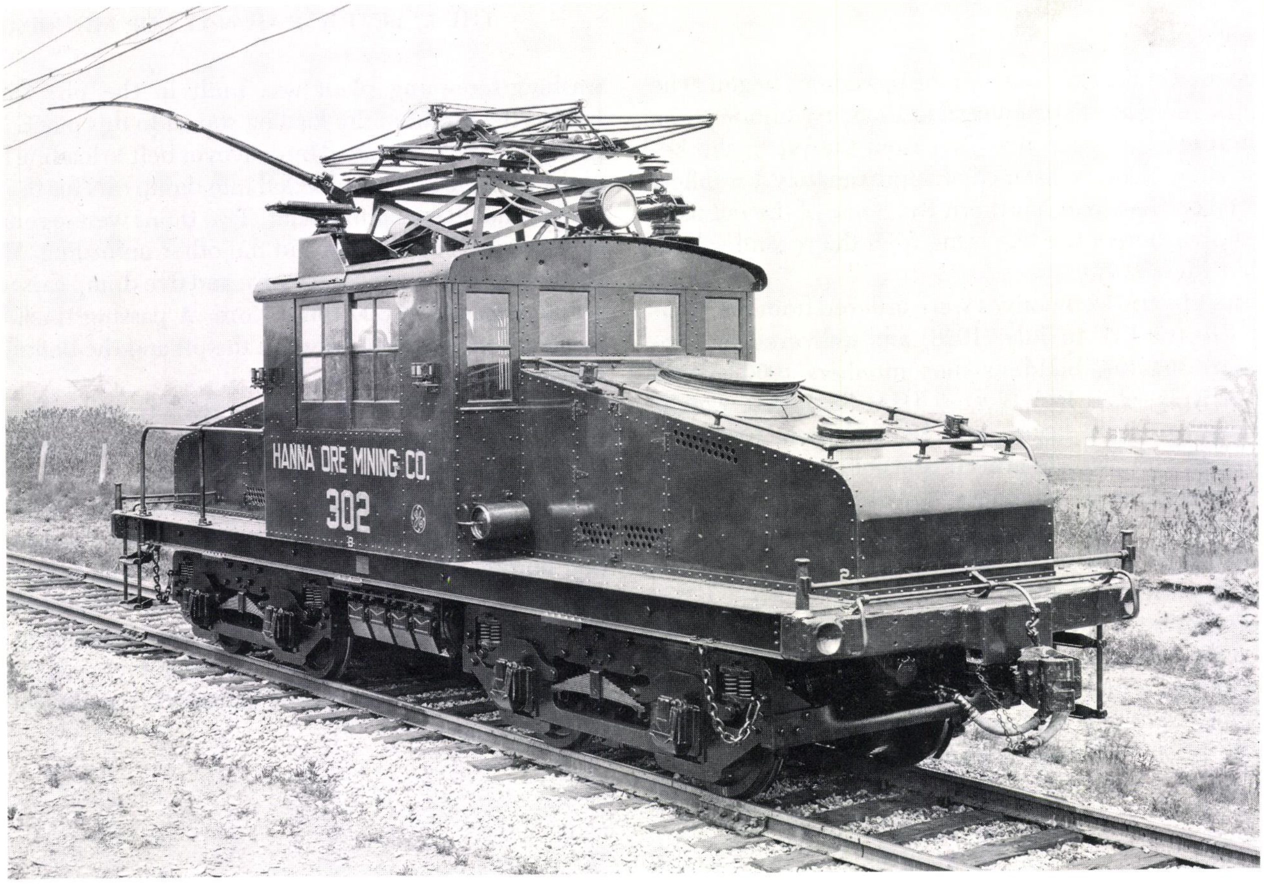
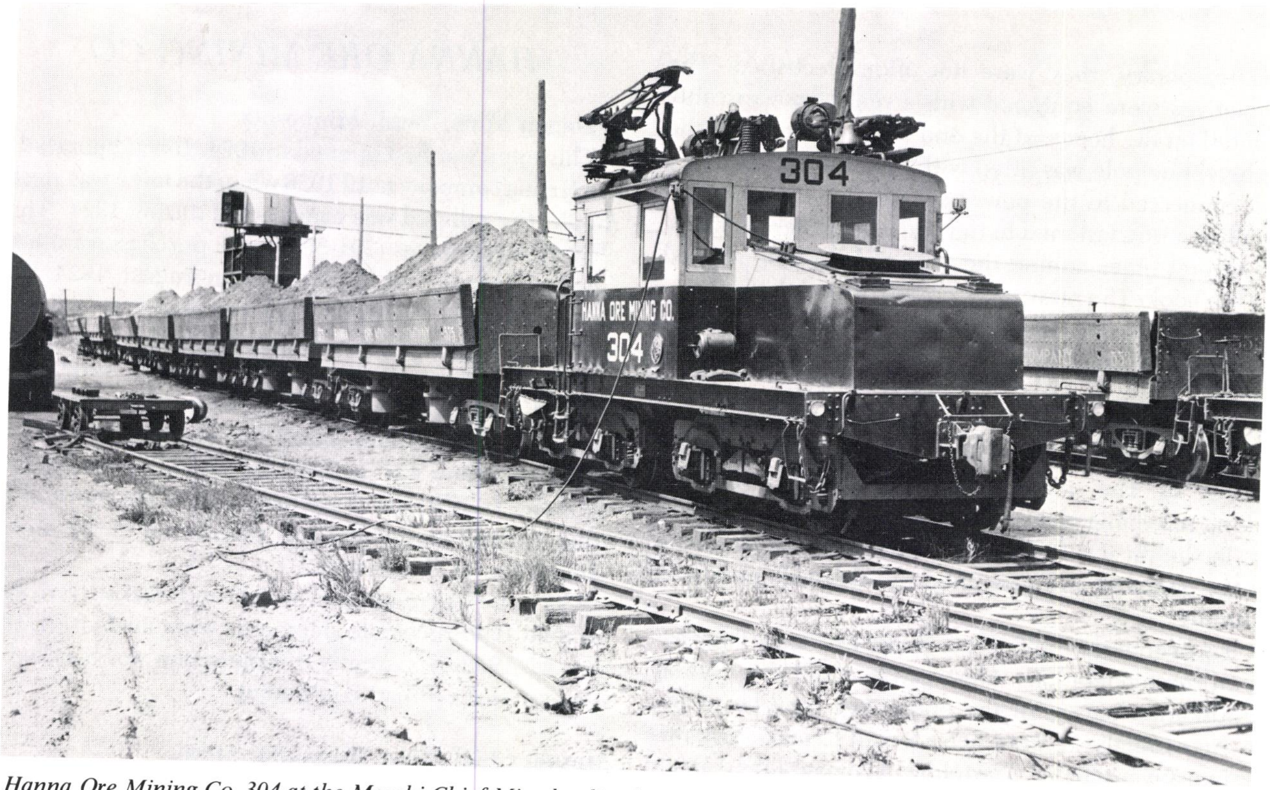
Apparently this company was influenced by both the



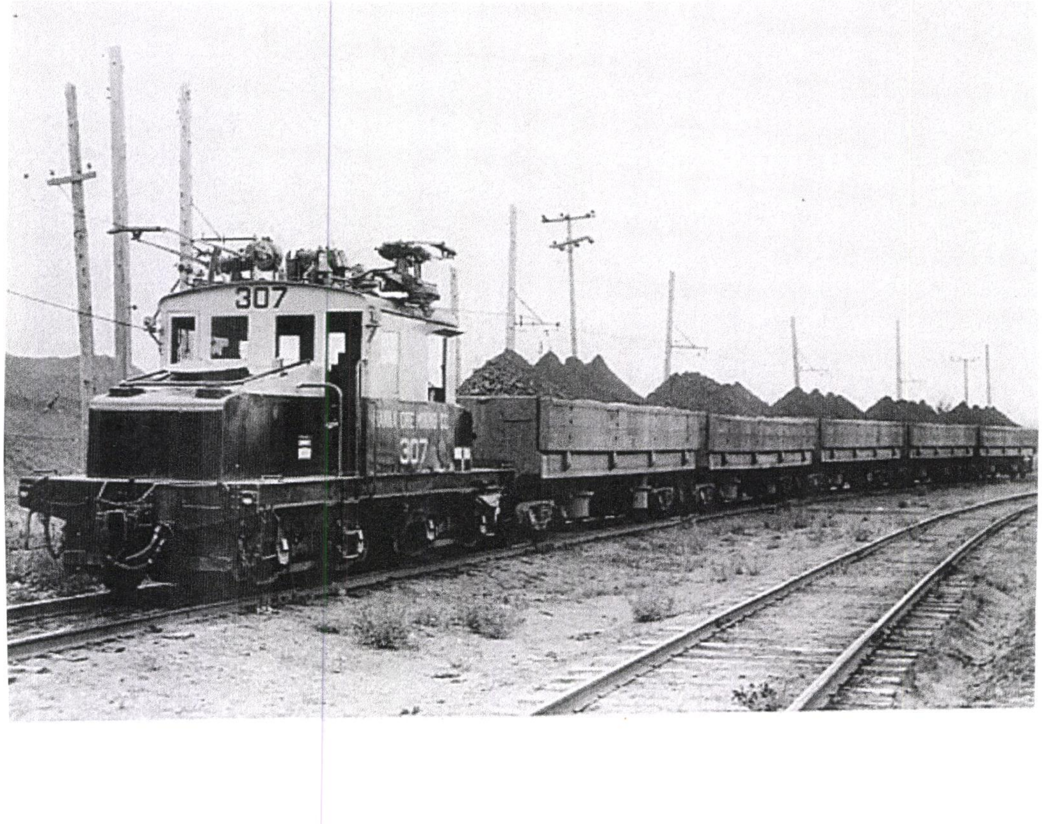


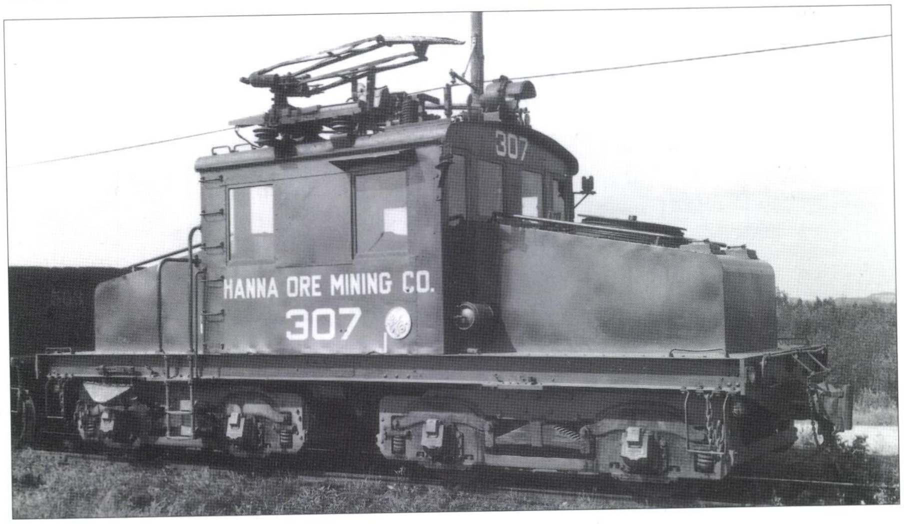
Facing Page
Hanna Ore Mining Co. operations at the Wabigon Mine, loading side-dump cars with iron ore from the open pit mine. This illustrates why offset overhead wire was necessary.

This Page
Hanna Ore Mining Co. locomotive 302 in August, 1924, at the Wabigon Mine, Buhl. Current collection devices included sidearm trolley, pantograph, and reel-mounted cable. (Both photographs Wayne C. Olsen collection)


304
HANNA ORE MINING CO.
304

Hanna Ore Mining Co. 304 at the Mesabi Chief Mine loading bins operating with the reel-mounted cable. Note the covered belt conveyor running from the mine floor to the loading bins. (Wayne C. Olsen)

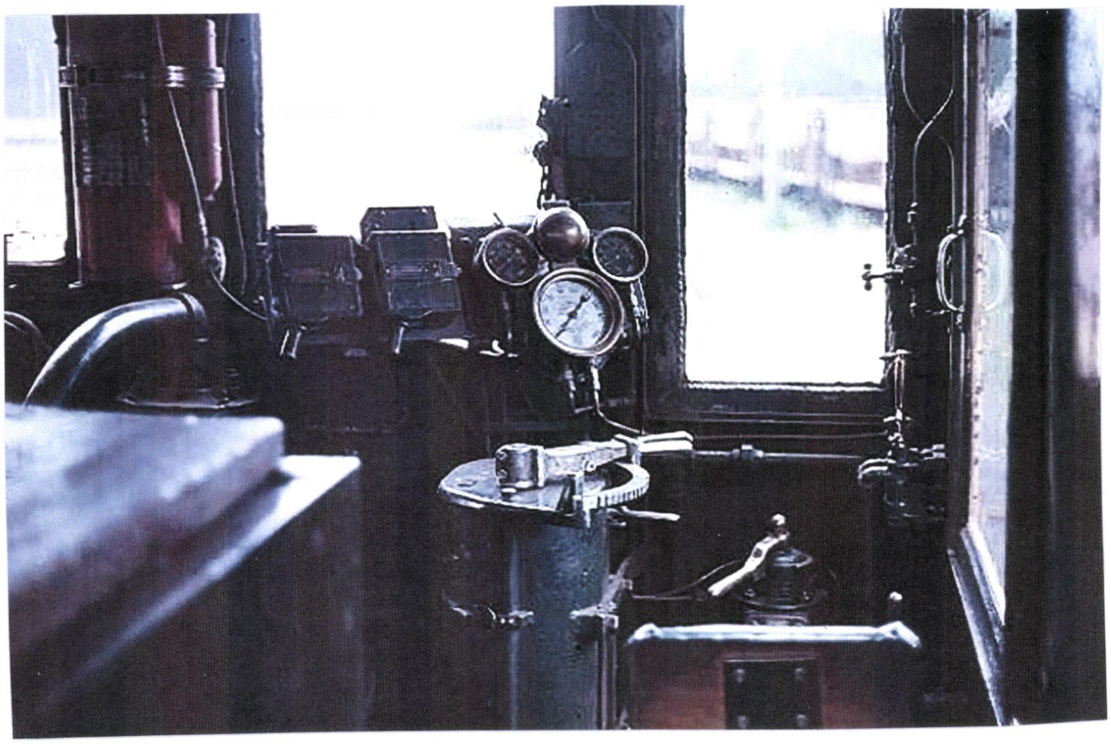

307
HANNA ORE MINING CO.
307

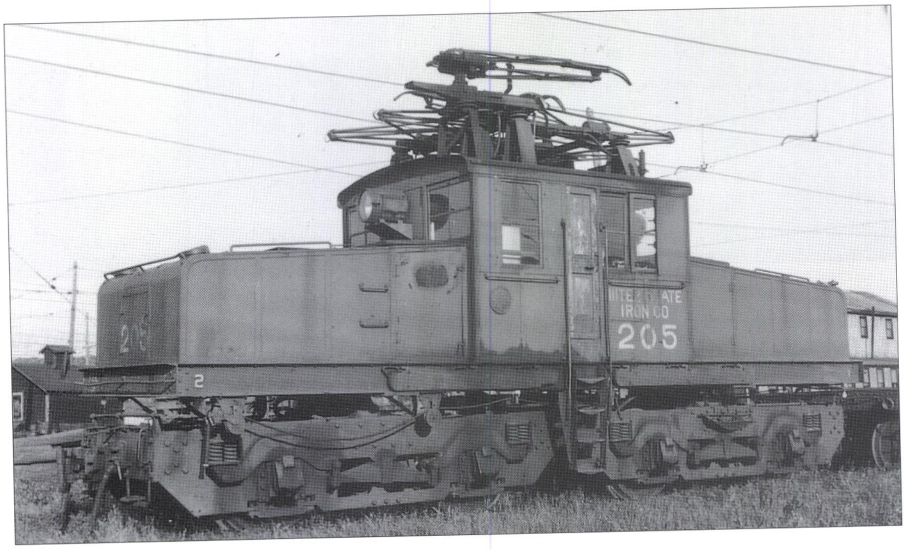


One market that was exploited by GE and ignored by competitor Westinghouse was open-pit mine railroading. Exports of interurban-style locomotives for use in mining began in 1919 and by 1924 electric units were working in Minnesota iron mines. Hanna Ore Mining #304-307 (GE #10603-606 of 1928) utilized offset pantographs and a radical new truck equalization system—as well as "HM" (Hoist and Mining) traction motors—to differentiate them from line-haul electrics; they were *not* fitted with articulated trucks. Hanna #307 poses at Keewatin, Minnesota, in August 1949.

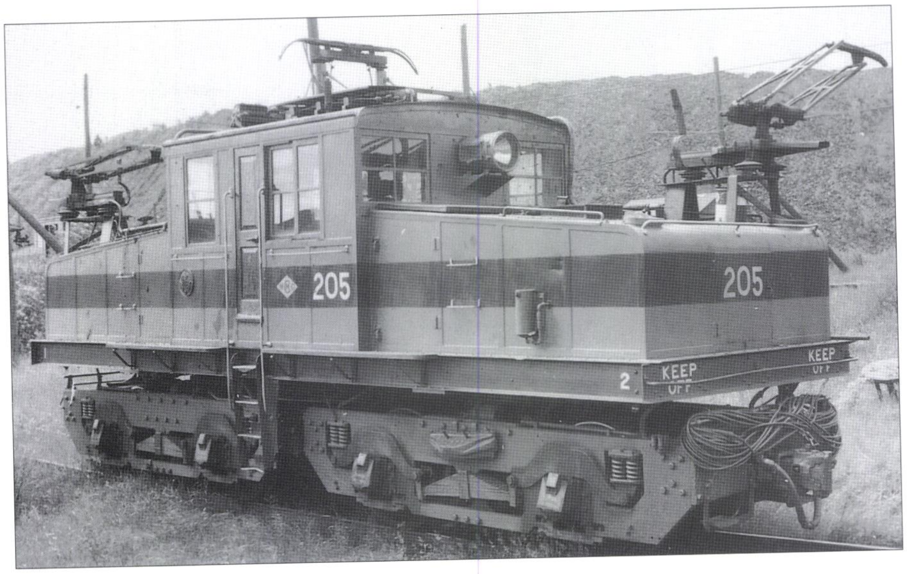
(R. C. Gray: Marre collection)

HANNA ORE MINING CO.
306

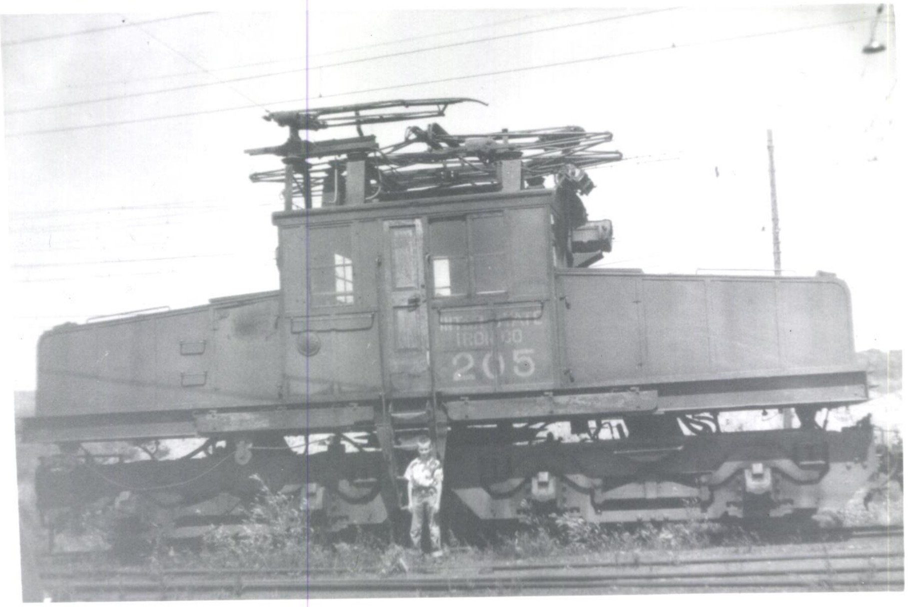




By the 1920s, GE was fabricating articulated truck side frames from flame-cut slabs of steel, rather than bolting together numerous parts or commissioning a casting from a foundry. Modeling this more rugged feature (visually identical to trucks used at Utah Copper) is Interstate Iron Co. #205, GE #11387 of 1930, near Calumet, Michigan in August 1949. This open-pit iron mine purchased eight of these machines in both 75 ton and 83 ton sizes.
(R. C. Gray: Marre collection)

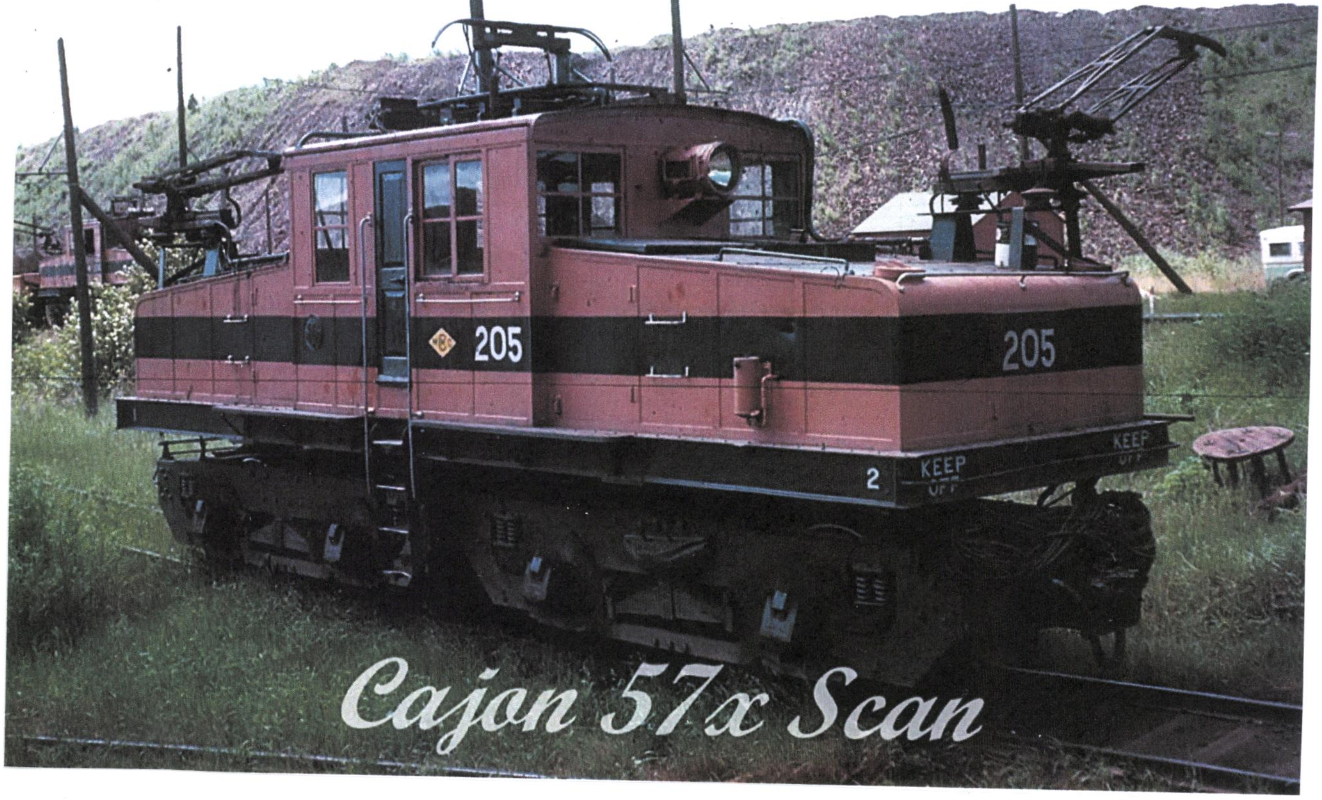


In 1955, the Interstate Iron Company sold their #204-206 (C/Ns 11386-11388) to Mesaba-Cliffs Mining Company for use in the Hill-Trumbull Mine at Marble, Minnesota. Side pantographs were moved from the cab roof out onto the hoods—and the locomotives given a brighter paint job. All three were retired about 1972 and apparently scrapped. Here is #205 again on June 9, 1959. *(L. A. Marre collection)*



July 1952 @ Calumet

1959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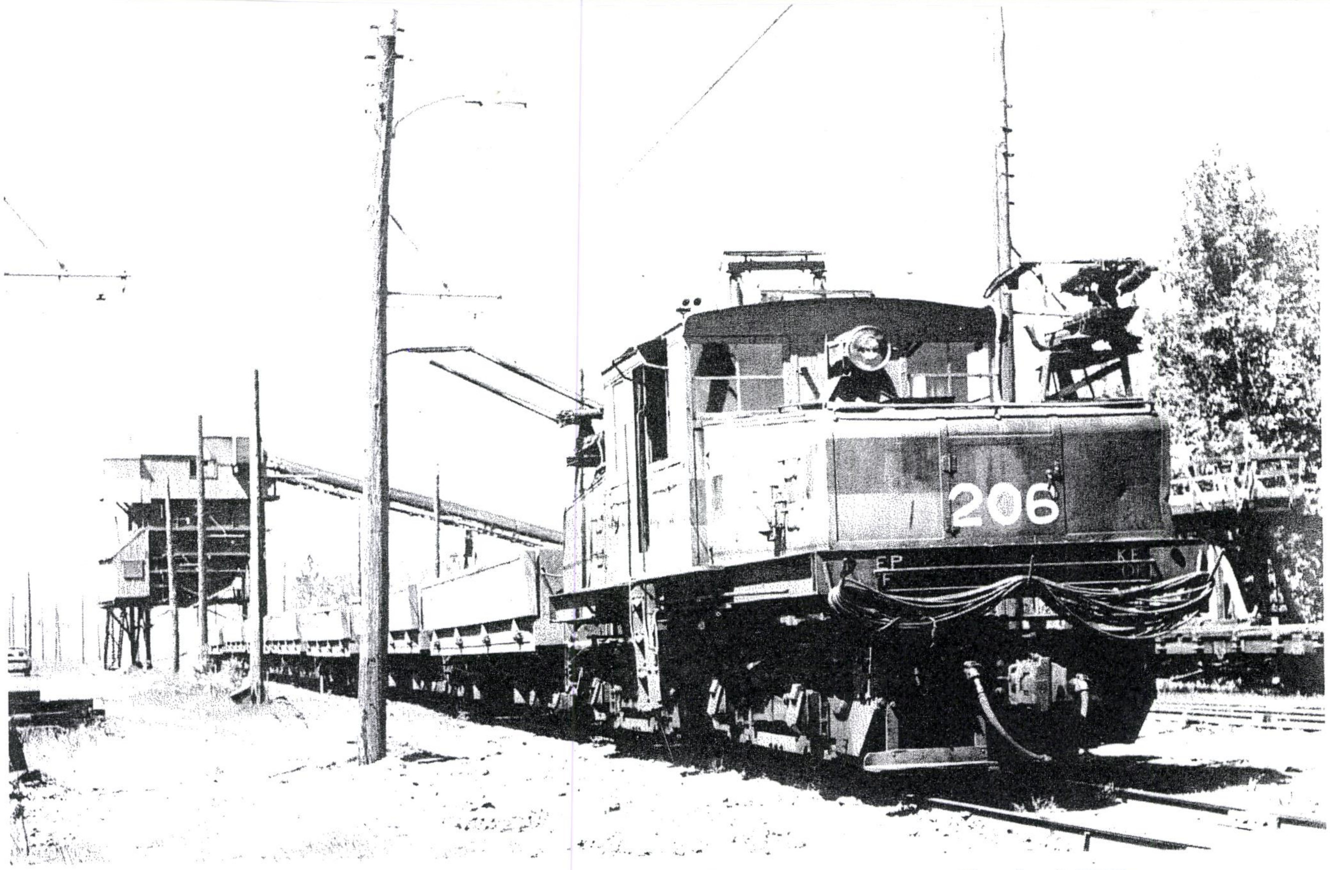
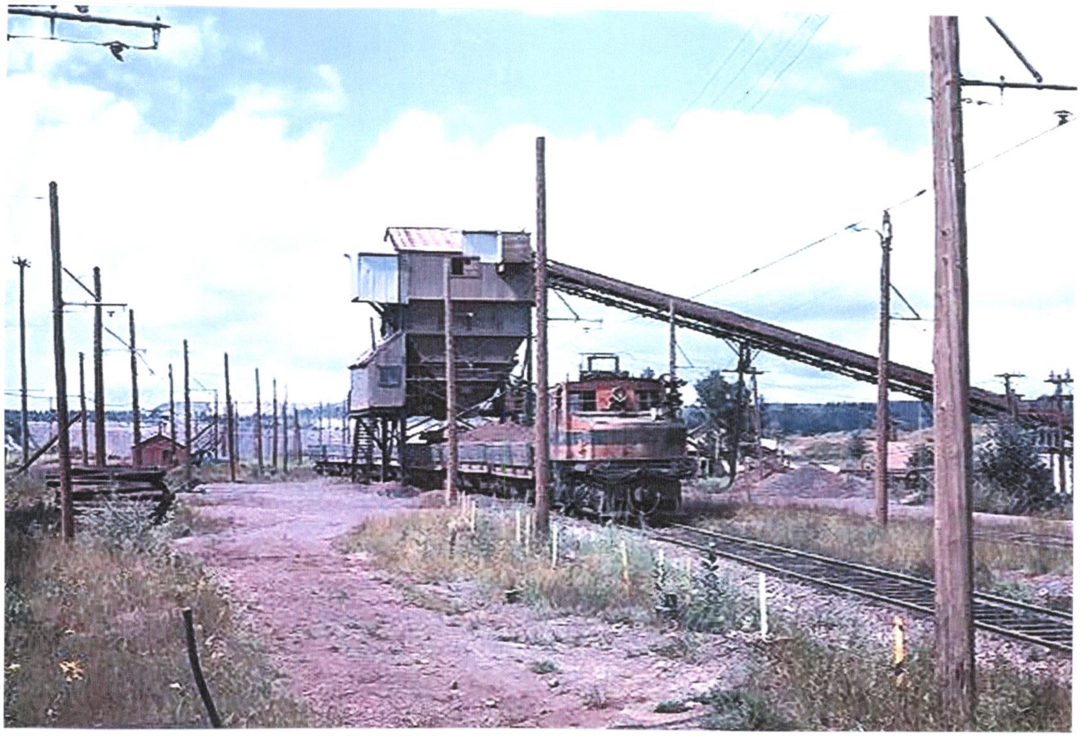


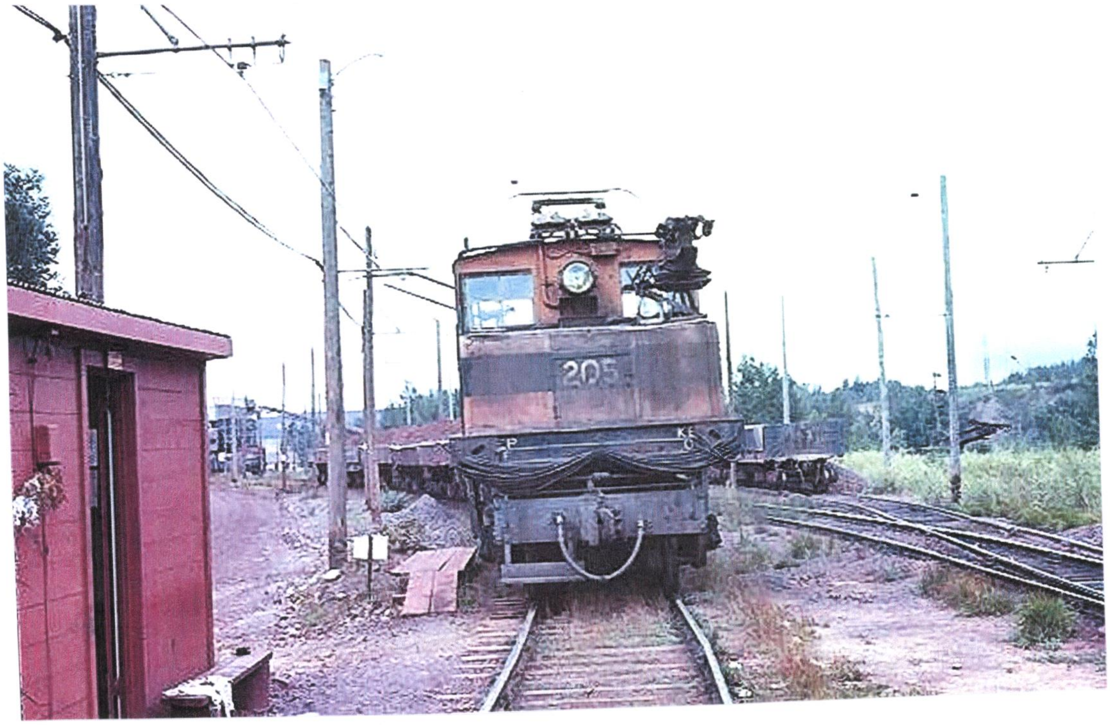
Frank A. King

An 85-ton General Electric steeple cab spots the loading pocket at Cleveland Cliffs Mining Company's Gross-Marble mine in 1970. The offset pantograph facilitated shovel loading in the pit.

water. Near Marble they crossed over the short electric line owned by Cleveland-Cliffs Mining.

6-59

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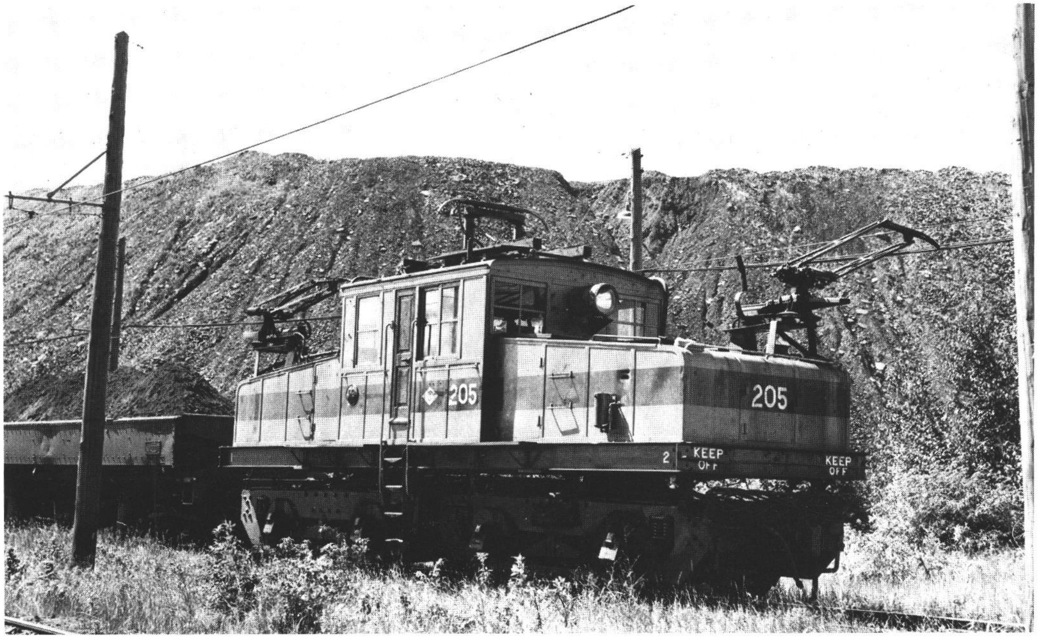
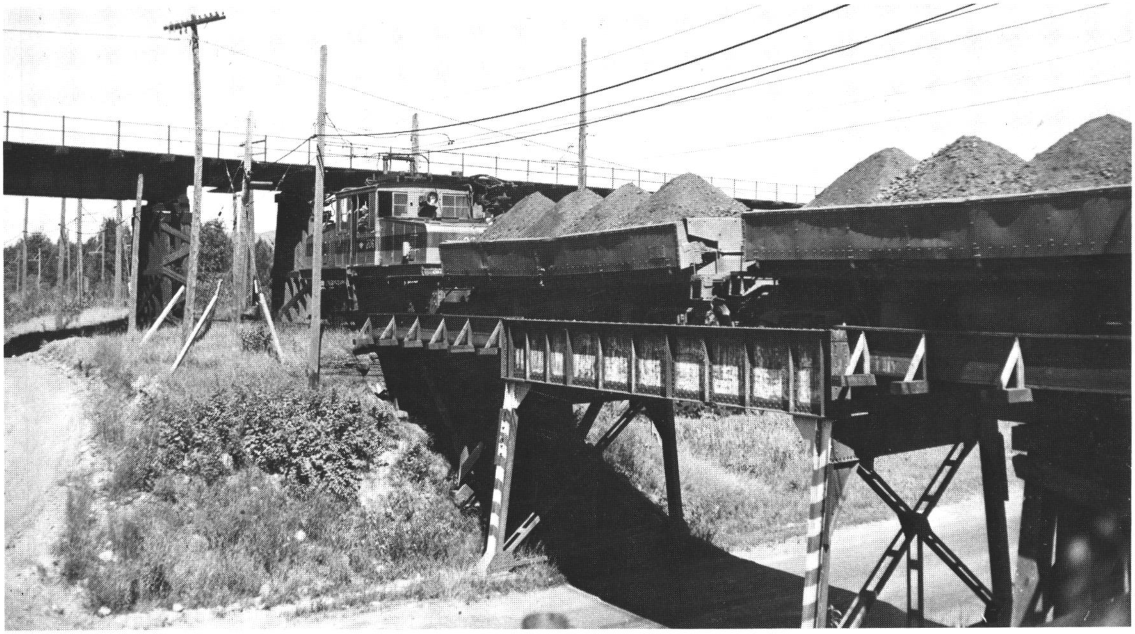
205

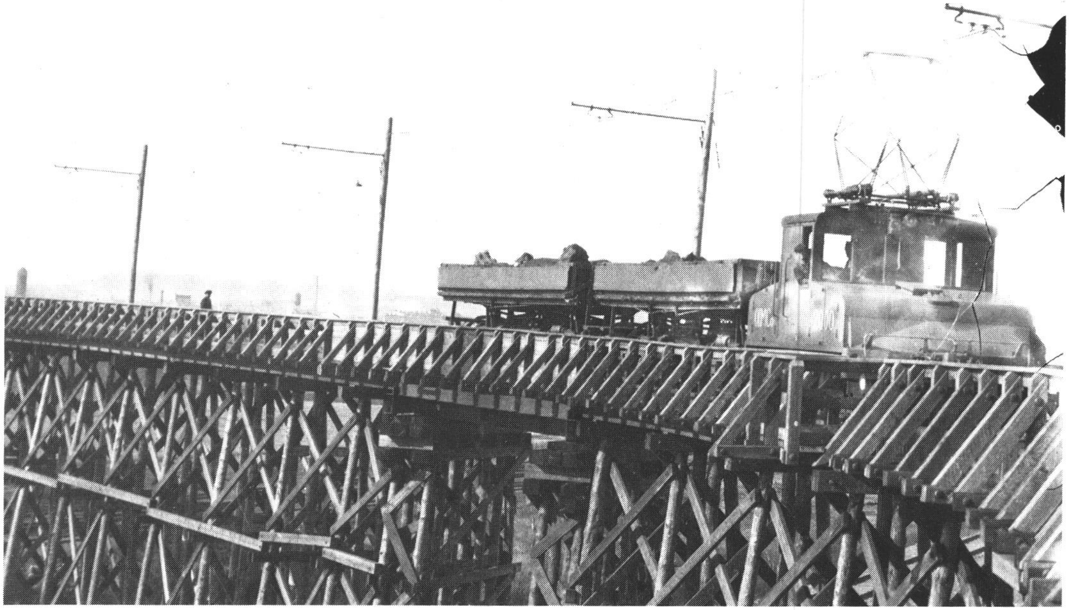


Above: Cleveland-Cliffs Iron Co. 205 (former Inter-State Iron Co. 205) at the loading area operating with side-arm trolley.

Below: Cleveland-Cliffs Iron Co. 206 pushing a loaded train to the concentrator drawing current through the roof-mounted slide collector. The triple level crossing involved highway 169 and the Great Northern Ry.

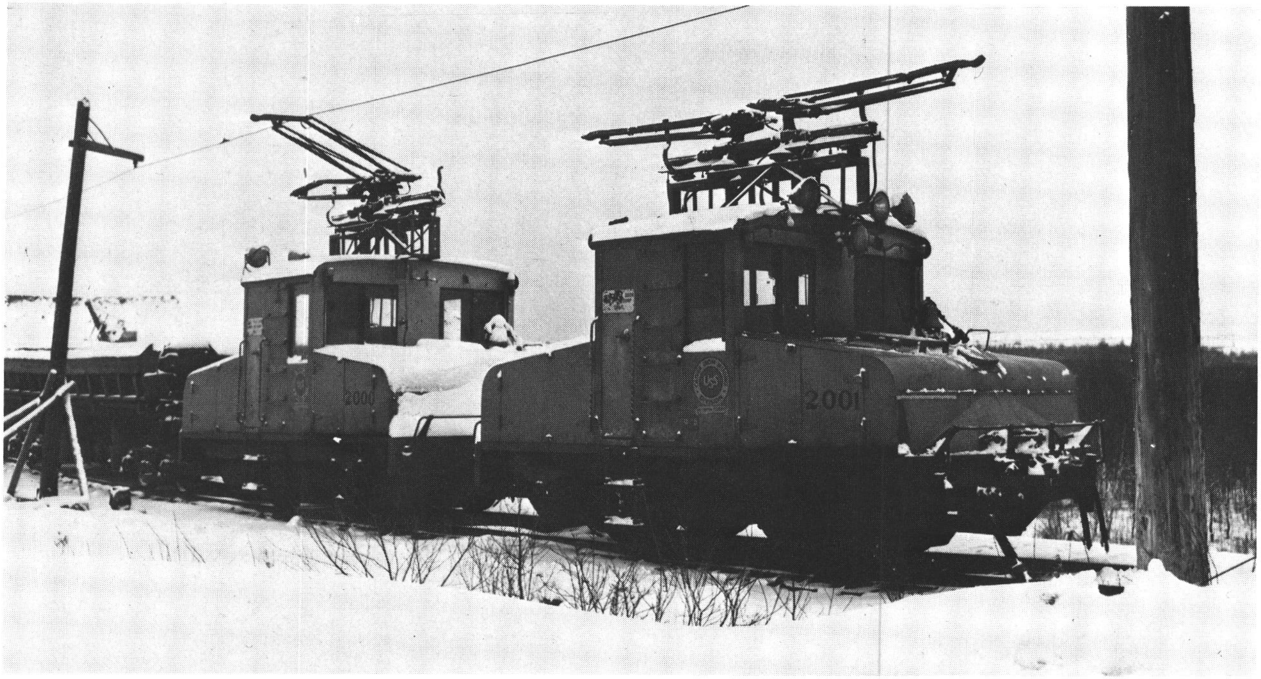
(Both photographs Wayne C. Olsen)





Above: Oliver Iron Mining Co. 2000 and train on the rock trestle from the Virginia Crusher in July, 1924. (Frank A. King collection)

Below: Oliver Iron Mining Co. 2000 and 2001 at the Hull-Rust Crusher, Hibbing, in the late 1960's. Side-arm trolleys have replaced the pantograph. Note the portable overhead wire support pole at the left; these were used extensively by all the mining companies for tracks on the pit floor which were constantly being relocated. (Richard Stoner)



Walker-Hill #5 Mine 1952-54 shipments by Gross Marble Mine; operated in conjunction with Arcturus Mine by Oliver Iron Mining Div. (U. S. Steel Corp.), 1955 to date

Hill-Trumble Mine (Gross-Marble) Operated as Gross-Marble Mine by Oliver Iron Mining Co., 1942-51, and by Oliver Iron Mining Div. (U.S. Steel Corp.), 1952-1955; operated as part of Hill-Trumbull group by the Mesaba-Cliffs Mining Co. (The Cleveland-Cliffs Iron Co.), 1955 to date

Hill-Trumbull Mine (Hill) Operated by Oliver Iron Mining Co., 1910-16, and operated as part of Hill-Trumbull group by The Mesaba-Cliffs Mining Co. (The Cleveland-Cliffs Iron Co.), 1920 to date

Hill-Trumbull Mine (Potter) Operated as part of Hill-Trumbull group by The Mesaba-Cliffs Mining Co. (The Cleveland-Cliffs Iron Co.), 1954 to date

Hill-Trumbull Mine (Trumbull) Operated as part of Hill-Trumbull group by The Mesaba-Cliffs Mining Co. (The Cleveland-Cliffs Iron Co.), 1920 to date

Hill-Trumbull Mine (Walker-Hill Parcel 6) Operated as part of Hill-Trumbull group by The Mesaba-Cliffs Mining Co. (The Cleveland-Cliffs Iron Co.), 1953 to date

Delaware #1 Mine 1913 and 1947-50 shipments by Hill Annex and Hill-Trumbull Mines; operated by Oliver Iron Mining Div. (U. S. Steel Corp.), 1957 to date

Delaware #2 Mine Operated by Oliver Iron Mining Co., 1942-51, and by Oliver Iron Mining Div. (U. S. Steel), 1952 to date

Hill Annex Mine Operated by Inter-State Iron Co., 1917-51, and by Jones & Laughlin Steel Corp., Minnesota Ore Division, 1952 to date

Oliver Iron Mining Co.

Ore Crushing and Sizing Plants: Hibbing (Rust Crusher erected 1920), Virginia (Rouchleau Crusher), Sherman, Gilbert, Trout Lake, Stephens. Screens were installed at the Rust Crusher to separate rock from ore vial scalpers that dragged the rock from the screen. In the 1950's new re-screening facilities (remove the fines from the coarse ore) were installed at Sherman and Rouchleau. In 1953 the Acturus Concentrator was the first plant to use "heavy media" separation, followed by Trout Lake (1956), Rust Crusher (1957) and the Sherman (1960). The crushed ore is put into a slurry of ferrosilicon (an alloy of iron and silicone) and due to the specific gravity of the slurry, low density rock floats and the iron sinks.

Ore Washing Plants were located at: Plummer, Acturus, Hull, Sherman, Rouchleau, Stephens, Pioneer. Rake and screw classifiers were used.

OIMCo favored rail transportation in the mines: Hull-Rust-Mahoning (70 miles), Monroe Group, Sherman Group, Coleraine, Rouchleau.

End of natural ore: Hull-Rust production ceased early 1960's; Pioneer Mine Sizing Plant shut down 1967; Rouchleau Plant shut down in early 1970's; Sherman Plant closed 1981; Stephens/Donora Plants sold to Jones & Laughlin Steel Co., moved to McKinley Washing Plant, which shut down 1991.

Motor No.	186 650-1300 volt operation
Builder	Baldwin-Westinghouse (Serial #38154
Purchased from-	Interstate Iron Co. (Calumet, Minn.) through the Iron & Steel Products, Inc., Chicago, Ill. Numbered 210
When built-	Year 1912 (august)
Purchased by WCF&N-	1944
Delivered to Shops	11-29-44
Placed in service-	12-6-45
Length over all-	32' 2"
Width outside-	10' 1"
Length of cab-	18' 1½"
Width of cab-	9' 7½"
Height to floor from rail-	4' 7"
Height over all-	12'
Trucks:	
Single or double-	Double
Builder-	Baldwin
Truck centers-	17' 9"
Overhang:	
Front-	7' 3"
Back-	7' 3"
Wheel base-	7' 5"
Wheels: Size & Kind-	36" Steel (rolled)
Flange & tread-	1-3/8" 4-1/8"
Axles:	
Size-	7"
Kind-	Steel
Size of journals-	5½" X 10"
Motors:	
Kind-	Westinghouse 308-D-3
Horse power-	240 H. P.
Number-	Four
Gear ratio-	16 :: 57
Maximum tractive effort-	~~34,000 lbs.~~ 31,125 lbs.
Control-	Westinghouse H.L.
Lightning arrester-	Westinghouse - Type I. C.
Brakes:	
Kind-	Airbrakes - Westinghouse
Size of compressor-	Two - 50 cu. ft. D-4-K Westinghouse
Drawbars-	Rigid - MCB Coupler
Weight-	124,800 lbs.

Sold to B. Schultz Co.
Aug. 1, 1957.

Motor No.	187 650-1300 volt operation.
Builder-	Baldwin-Westinghouse (Serial #38298)
Purchased from-	Interstate Iron Co. (Calumet, Minn.) through the Iron & Steel Products, Inc., Chicago, Ill. Numbered 209.
When built-	Year 1912 (September)
Purchased by WCF&N-	1944
Delivered to Shops-	11-29-44
Placed in service-	10-16-45
Length over all-	32' 2"
Width outside-	10' 1"
Length of cab-	18' 1½"
Width of cab-	9' 7½"
Height to floor from rail-	4' 7"
Height over all-	12'
Trucks:	
Single or double-	Double
Builder-	Baldwin
Truck centers-	17' 9"
Overhang:	
Front-	7' 3"
Back-	7' 3"
Wheel base-	7' 5"
Wheels: Size & Kind-	36" Spoked steel
Flange & tread-	1-3/8" 4-1/8"
Axles:	
Size-	7"
Kind-	Steel
Size of journals-	5½" X 10"
Motors:	
Kind-	Westinghouse 308-D-3
Horse power-	240 H. P.
Number-	Four
Gear ratio-	16 :: 57
Maximum tractive effort-	~~34,000 lbs.~~ 31,125 lbs.
Control-	Westinghouse H. L.
Lightning arrester-	Westinghouse - Type I. C.
Brakes:	
Kind-	Airbrakes - Westinghouse
Size of compressor-	Two - 50 cu. ft. D-4-K Westinghouse
Drawbars-	Rigid - MCB Coupler
Weight-	125,500 lbs.

Replaced with a new sheet

MOTOR NO.	187 Equipped for 650-1300 volt operation
Builder-	Baldwin-Westinghouse (Serial #38298)
Purchased from-	Interstate Iron Co. (Calumet, Minn.) through the Iron & Steel Products, Inc., Chicago, Ill. Numbered 209.
When built-	Year 1912
Purchased by WCF&N-	1944
Delivered to Shops	11-29-44
Placed in service-	10-16-45
Length over all-	32' 2"
Width outside-	10' 1"
Length of cab-	18' 1½"
Width of cab-	9' 7½"
Height to floor from rail-	4' 7"
Height over all-	12'
Trucks:	
Single or double-	Double
Builder-	American Locomotive Co. Trucks
Truck center-	19' 6"
Wheel base-	7' 2"
Overhang:	
Front-	7' 3"
Back-	7' 3"
Wheels: Size & Kind-	36" Rolled Steel
Flange & Tread-	1-3/8" 4-1/8"
Axles:	
Size-	6½"
Kind-	Steel
Size of journals-	5½" X 10"
Motors:	
Kind-	G. E. 251-A
Horse Power	240 H.P.
Number-	Four
Gear Ratio-	13 :: 68
Control-	Westinghouse H. L.
Lightning arrester-	Westinghouse - Type I. C.
Brakes:	
Kind-	Airbrakes- Westinghouse
Size of compressor-	Two - 50 cu. ft. D-4-K Westinghouse
Drawbars-	Rigid - MCB Coupler
Maximum tractive effort-	30,000 lbs.
Weight-	120,100 lbs. 1-14-56

Sold to B. Schultz Co.,
Aug. 1, 1957.

Note: Trucks from Motor 190 placed in Motor. Motor 187 released for service 1-12-56.

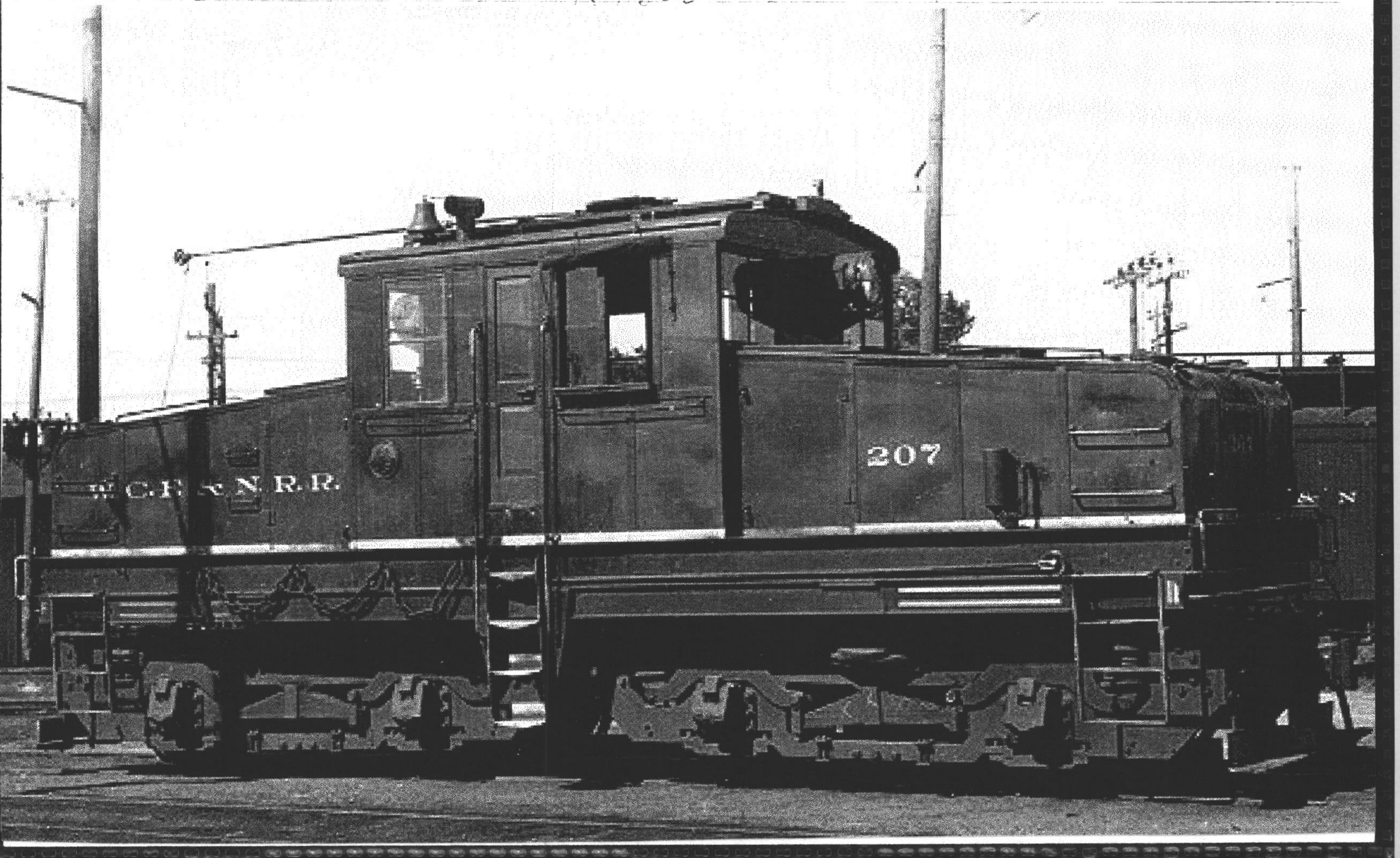
Motor No.	207 650 Volt Operation
Builder-	General Electric Co.
Serial Number-	11389
Purchased from-	Interstate Iron Co. (Calumet, Minn.) through the Iron & Steel Products, Inc., Chicago, Ill.
When built-	1931 (ordered 1930?)
Purchased by WCF&N-	1947
Delivered to Shops-	4- 3-47
In Shops to condition for operation-	4-28-47
Placed in service-	5-27-47
Length over all-	37' 6½"
Width outside-	10' 5½"
Length of cab-	11'
Width of cab-	10'
Height to floor from rail-	6'
Height over all-	14' 10"
Trucks:	
Single or double-	Double
Builder-	General Electric Co.
Truck centers-	17' 2¼"
Overhang:	
Front-	8' 4¼"
Back-	8' 4¼"
Wheel base-	8'
Wheels: Size & Kind-	46" Rolled steel
Flange & tread-	1-3/8" 4-1/8"
Axles:	
Size-	7"
Kind-	Steel
Size of journals-	6½" X 12"
Motors:	
Kind-	G. E. Type HM818-A-2
Horse power-	250
Number-	4
Gear ratio-	85 :: 18 2½" pitch

Sold to B. Schultz Co.
Aug. 1, 1957.

(over)

Motor No.	207 (continued)
Maximum tractive effort-	~~30,000 lbs.~~ 41,500 lbs.
Control-	Type M Controller C-505
Lightning arrester-	W. H. Type I. C., 4 Mfd. condensor, 750 volts, style #970686B
Brakes:	
Kind-	Westinghouse 14-EL No. 6 distributing valve
Size of compressor-	One - CP-26 Two-stage Railway Compressor
Couplers-	Sharon
Heaters-	Equipped with six 1200-watt cab heaters
Weight of trucks-	93,200 lbs.
Weight of motor-	166,400 lbs. (Must be total weight)

9600



Motor No.	208	650 Volt Operation
Builder-	General Electric Co.	
Serial Number-	11390	
Purchased from-	Interstate Iron Co. (Calumet, Minn.) through the Iron & Steel Products, Inc., Chicago, Ill.	
When built-	1931 (ordered 1930?)	
Purchased by WCF&N-	1947	
Delivered to Shops-	4- 3-47	
In Shops to condition for operation-	4- 4-47	
Placed in service-	4-23-47	
Length over all-	37' 6½"	
Width outside-	10' 5½"	
Length of cab-	11'	
Width of cab-	10'	
Height to floor from rail-	6'	
Height over all-	14' 10"	
Trucks:		
Single or double-	Double	
Builder-	General Electric Co.	
Truck centers-	17' 2¼"	
Overhang:		
Front-	8' 4¼"	
Back-	8' 4¼"	
Wheel base-	8'	
Wheels: Size & Kind-	46" Rolled steel	
Flange & tread-	1-3/8" 4-1/8"	
Axles:		
Size.	7"	
Kind-	Steel	
Size of journals-	6½" X 12"	
Motors:		
Kind-	G. E. Type HM818-A-2	
Horse power-	250	
Number-	4	
Gear ratio-	85 :: 18 2½" pitch	

Sold to B. Schultz Co.,
Aug. 1, 1957.

(over)

Motor No. 208 (continued)

Maximum tractive effort- ~~30,000 lbs.~~ 41,500 lbs.

Control- Type M Controller C-505

Lightning arrester- G. E. Type M Form D-3

Brakes:

Kind- Westinghouse 14-EL No. 6 distributing valve

Size of compressor- One - CP-26 Two-stage Railway Compressor

Couplers- Sharon

Heaters- Equipped with six 1200-watt cab heaters

Weight of trucks- 93,200 lbs.

Weight of motor- 165,700 lbs. (must be total weight)

SOUTH ST. PAUL RAPID TRANSIT CO.

SOUTH ST.PAUL RAPID TRANSIT CO.

South St.Paul, Minnesota

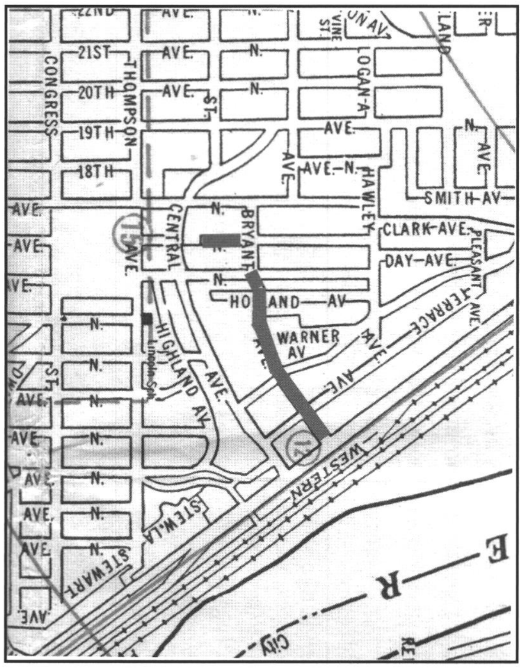
South St.Paul had separated from West St.Paul in 1887 to form a new suburb of St.Paul. Existing public transportation ended far north of the bluff above Concord St. where C. W. Clark and John H. Bryant owned substantial land they were attempting to develop. These promoters felt their objectives could be more easily accomplished if there were a direct, fast transportation route into downtown St.Paul. The Enos Electric Railway Company, located in New Jersey, had developed and patented a monorail system. Clark and Bryant decided this was the transit system of the future and the answer to their problem.

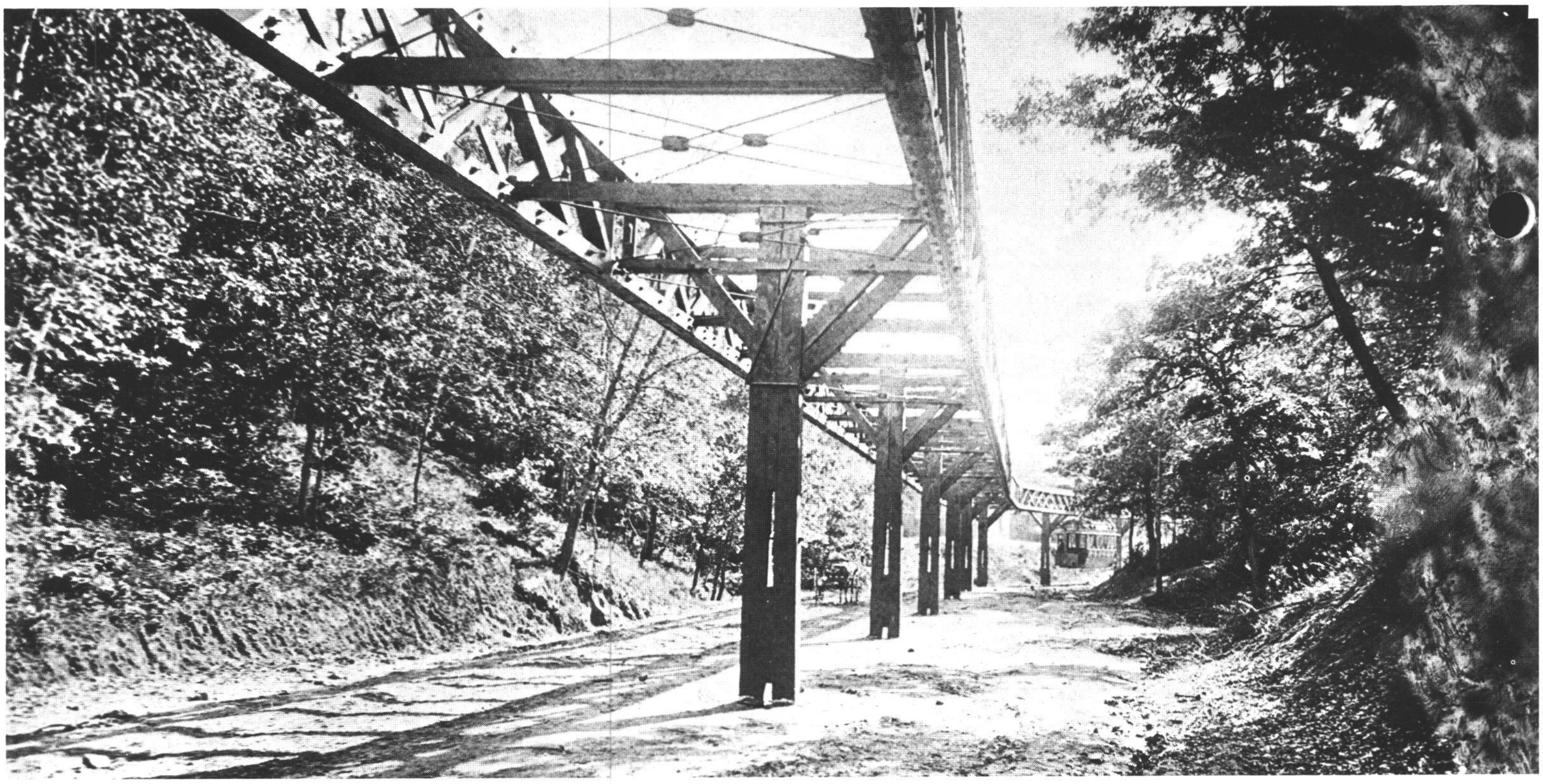
Construction began in 1887 at what is now the 700 block of 16th Ave. N. in South St.Paul (supposedly in front of 755 16th Ave. N.) on the monorail overhead structure. From this point the structure curved north onto Bryant Ave. and then down the Bryant Ave. hill ending at Concord St., about 3/4 mile in length.

In the meantime the company had applied to the St.Paul City Council for a franchise to run the line into the city. The complete proposal called for the line to operate north on Concord St. to a proposed terminus at the St.Paul Union Depot. Ten cars were to be operated over the eight miles of overhead structure at speeds of up to 70 m.p.h. The St.Paul City Council discussed the matter for several months but finally refused to grant the franchise. Objections to the overhead structure, horses frightened by the noise of the electric powered cars, and insufficient financing were all cited for the refusal. Being optimists Clark and Bryant decided to go into business anyway. The line was completed from Concord St. and Bryant Ave. to, according to one source, 16th Ave. N. and Thompson Ave., all in South St.Paul. A surviving photograph shows the original structure, and dimly visible, two additional structures, one continuing south on 16th Ave. N. and the other perpendicular to it heading westward.

The inaugural runs were made May 10, 1888, when two carloads of aldermen, city officials, financiers, and businessmen from St.Paul and Minneapolis were carried over the line to demonstrate the practibility of the monorail system. At the conclusion of the experiment, which worked perfectly, lunch was served followed by brief speeches expressing enthusiasm over the outlook.

But failure was only a matter of time for the monorail that had no place to go. After a short time operations were discontinued. Several years later the overhead structure was dismantled. Clark and Bryant sustained substantial financial losses on the project which took them many years to repay.

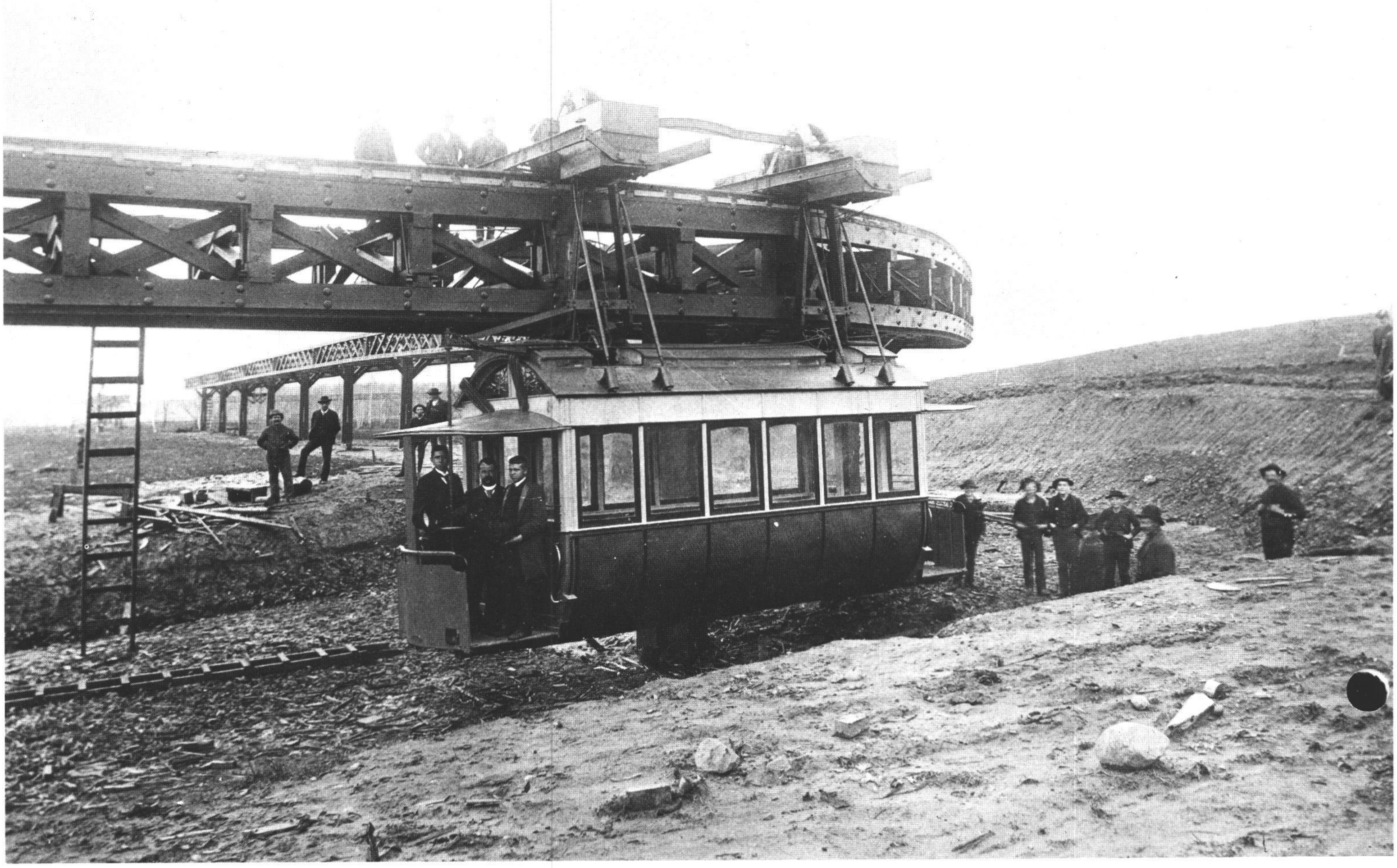


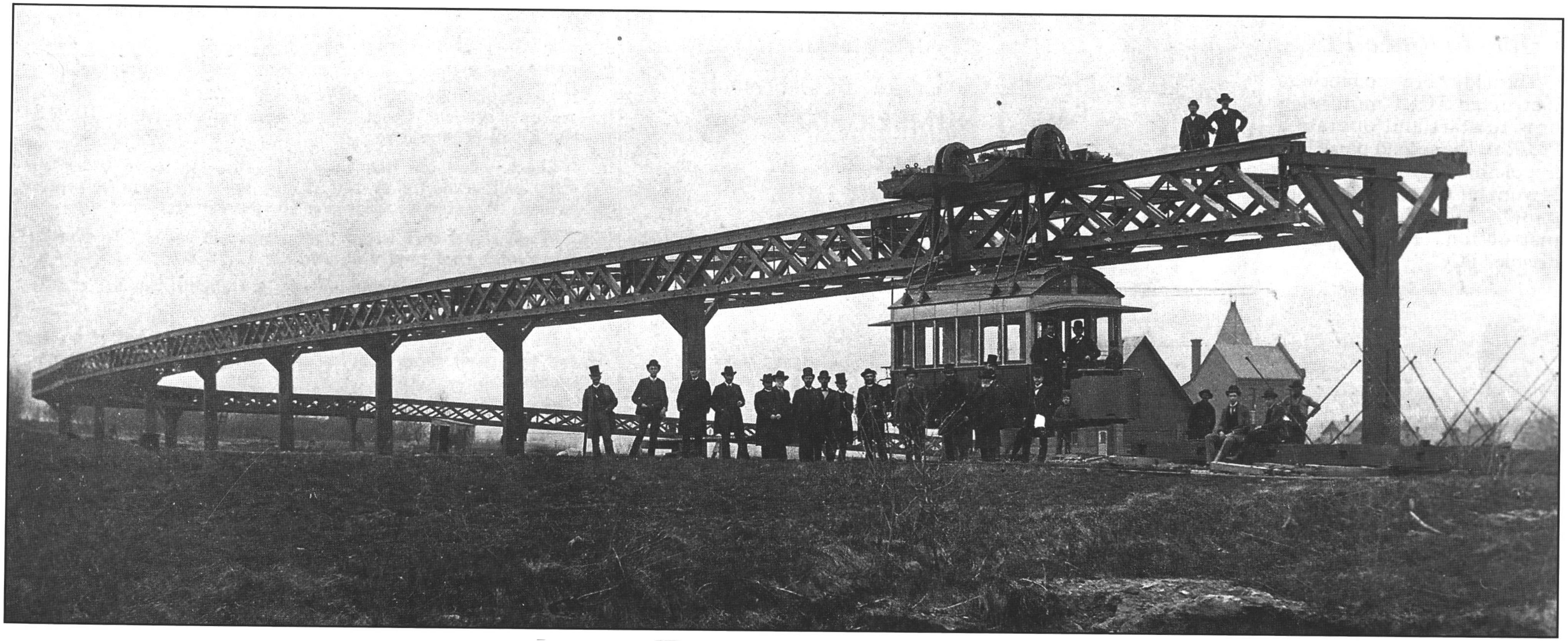


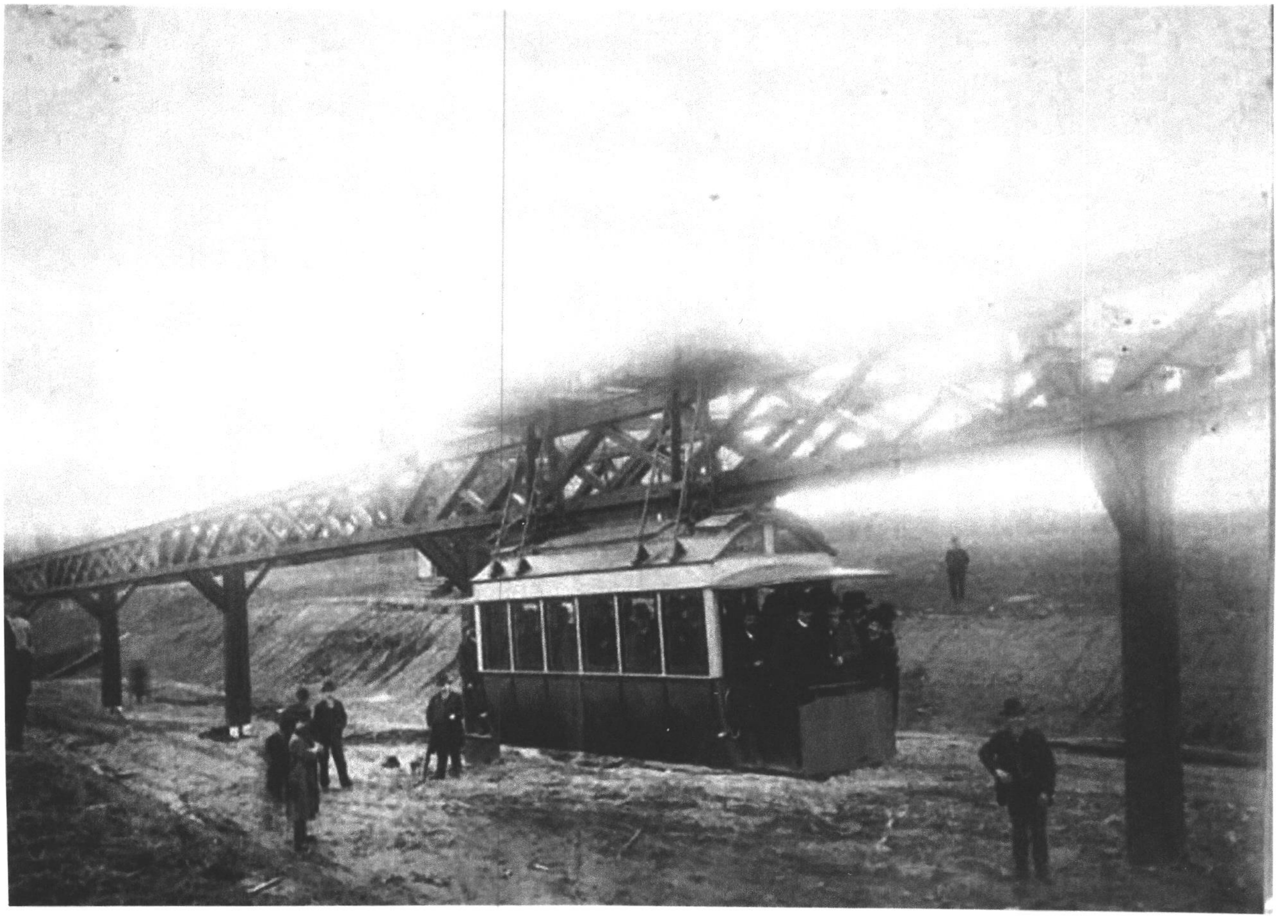
Above: South St. Paul Rapid Transit Co. monorail car ascending the Bryant Ave. hill, westbound.

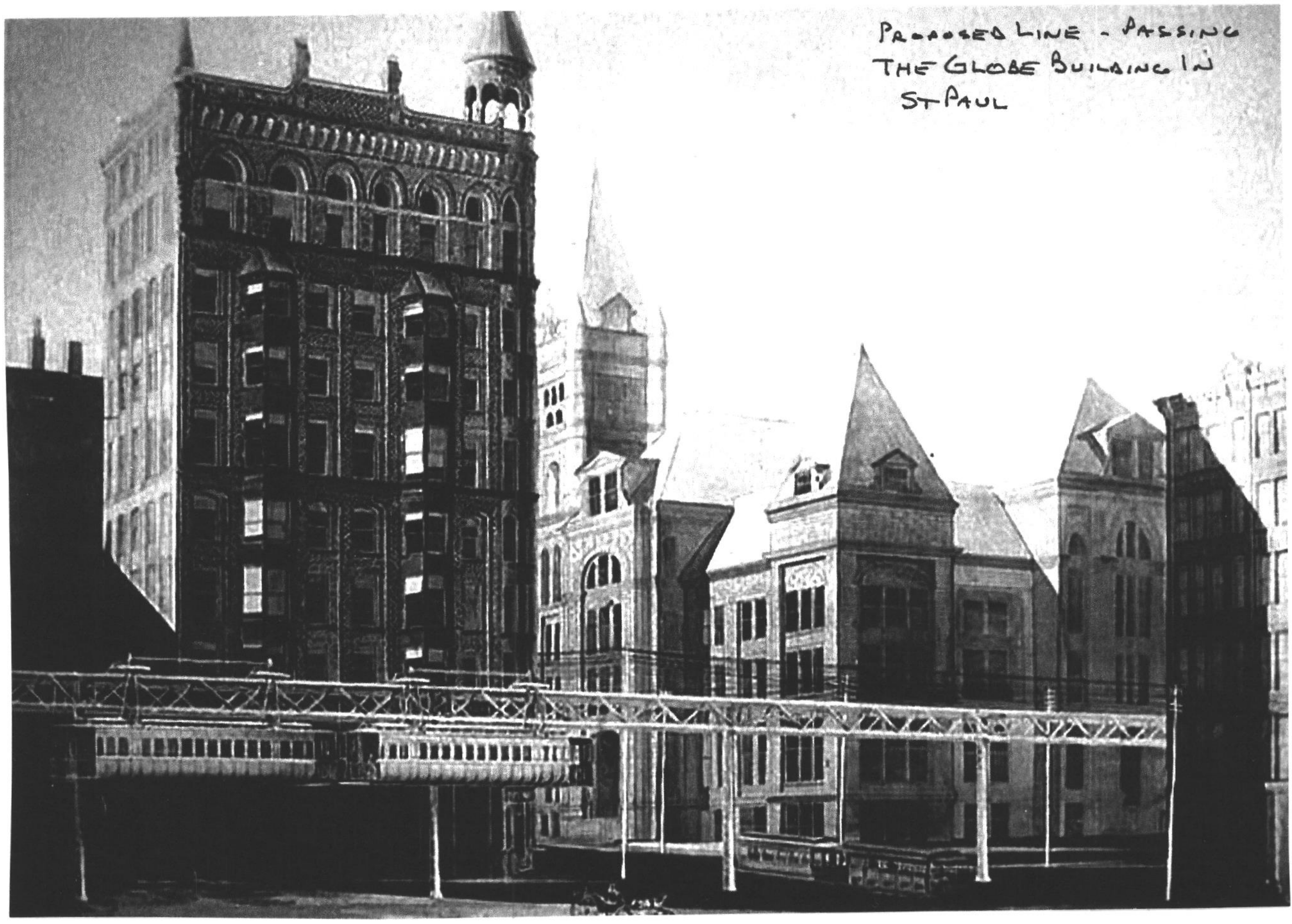
The monorail car at the point where the structure curved from Bryant Ave. onto 16th Ave. N. The structure in the background continues south on 16th Ave. Dimly visible in the background are portions of two additional structures, one continuing south on 16th Ave., and the other perpendicular to it heading west.

(Both photographs Minnesota Historical Society collection)









PROPOSED LINE - PASSING
THE GLOBE BUILDING IN
ST PAUL

WILL TRY AGAIN.

The Enos Electric Railway Company Say that They Will Make Another attempt to Secure a Franchise.

"Will you make an attempt to get an ordinance granting your company a franchise to build an elevated railroad, through the new council?" was asked of the representative of the Enos Electric Railway Company yesterday. "Yes, I think we will introduce a resolution into the first session of the new council," he said. "We want to begin work on the line this year, and if anything is to be done it must be done at once. I do not think that the people living along the streets where our line is supposed to run, understand how it is to be erected. We only have one post on the street, and these at some distance apart, where other companies would have to have four: we only need two rails, without ties, where others use four rails and ties. We do not shut out a particle of light, and on streets where the steam line would run it would be sometimes like not having any sun in narrow streets, almost forming a bridge.

The bottom of the cars will be from 10 to 14 feet above the surface of the ground, allowing any vehicle to pass underneath. The streets along the line that we wish to run would rapidly change from resident to business streets, and the value of property along the line would be largely increased. Minneapolis seems favorably disposed towards having an elevated railroad, and I think that if the St. Paul council grants us a franchise we will have no trouble to run on to bridge square in that city. We will make the distance in about 11 minutes, including all stops, and will run a train every five minutes if travel warrants it. We would start the work of erection in St. Paul immediately, and finish to Minneapolis, and then make a connection with one line in South St. Paul. Richmond, Detroit, Scranton and many smaller cities are successfully using electricity, while Omaha and St. Louis have just adopted it in their street railway, and I am told that there is no reason why St. Paul should not follow in their footsteps. The advantages of electricity is apparent to all as a motor power. There is no noise, no steam, no smoke and no cinders, while the structure takes up only about one-third of the space that any other elevated railway system would. In fact, our structure is so simple that I cannot understand how any one can object to it when we consider the advantages derived."

MPLS TRIBUNE 5-20-1888

THE ENOS ELECTRIC RAILWAY.

The committee then took up the ordinance granting the Enos Electric railway the right to construct its road on and over certain streets, connecting the business districts of St. Paul and Minneapolis. Petitions in favor of the road were read from the Inter-Urban Citizens' League, the rapid transit committee of the chamber of commerce, the St. Paul real estate board and various bodies of citizens. Protests were read from Chester Hitchcock and other citizens, and the property owners on Cedar and Exchange streets and Nebraska street. Remarks favoring the ordinance were made by D. D. Merrill and Dr. E. Snyder, but they were in a hopeless minority and amid great applause the opposition speakers, Messrs. W. F. Mason, of the Taxpayers Union, Wm. J. Cutter, John Kerwin, A. Winter and Nick Pottgieser got in their deadly work against the electric railway. Several legal questions arose in the discussion and were explained by Ald. Sanborn and City Attorney Murray, who said that much of the opposition arose from the fact that it was generally thought the railroad would damage property without making redress. This was a mistake; the company was obliged to pay all damages arising from condemnation of property. The only objection City Attorney Murray had to the ordinance was that it did not make the company pay damages before putting up a rail near any property. The matter was finally laid over to be acted upon next Friday evening. In the meantime friends and enemies of the road will bustle for supporters.

Mpls Tribune 6-30-1888

RAPID TRANSIT.

The Enos Electric Railway Ordinance Discussed by Aldermen Yesterday.

The Enos electric railway ordinance was under discussion at a joint meeting of the council committee on railroads and the aldermen of the Sixth and Seventh wards held yesterday morning. Ald. Cloutier explained that the company wants to change its route and instead of coming in on the East Side and crossing the steel arch bridge would like to bridge the river at Nineteenth street south and come up Fourth street to Hennepin avenue. Ezra Farnsworth, Ald Lawrence and A. E. Sheldon favored the scheme. Ald. Stoft wanted to hear from property owners along the proposed line of road and Ald. Stoneman wanted the company to give $10,000 bond to put the road in running order in the time stated in the ordinance. Mr. Lawrence said the company would forfeit $25,000 unless the road was in every way satisfactory.

MPLS TRIBUNE 7-1-1888

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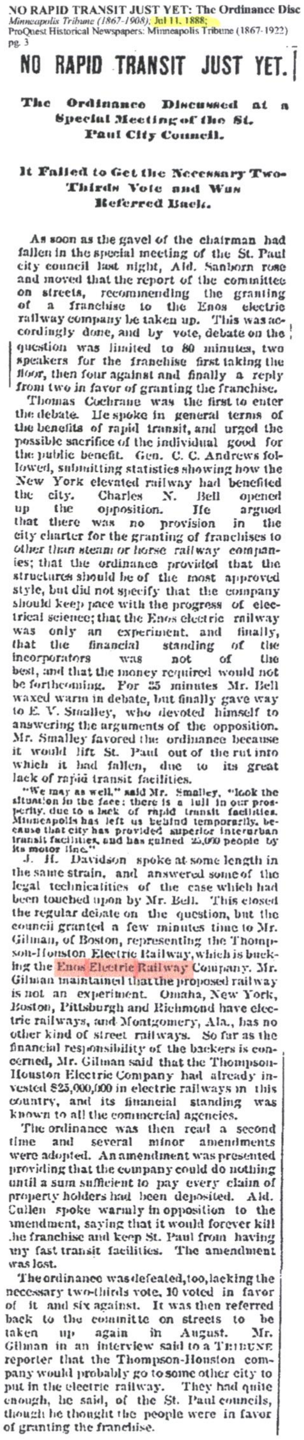


NO RAPID TRANSIT JUST YET: The Ordinance Disc
Minneapolis Tribune (1867-1908); Jul 11, 1888;
ProQuest Historical Newspapers: Minneapolis Tribune (1867-1922)
pg. 3

NO RAPID TRANSIT JUST YET.

The Ordinance Discussed at a Special Meeting of the St. Paul City Council.

It Failed to Get the Necessary Two-Thirds Vote and Was Referred Back.

As soon as the gavel of the chairman had fallen in the special meeting of the St. Paul city council last night, Ald. Sanborn rose and moved that the report of the committee on streets, recommending the granting of a franchise to the Enos electric railway company be taken up. This was accordingly done, and by vote, debate on the question was limited to 80 minutes, two speakers for the franchise first taking the floor, then four against and finally a reply from two in favor of granting the franchise.

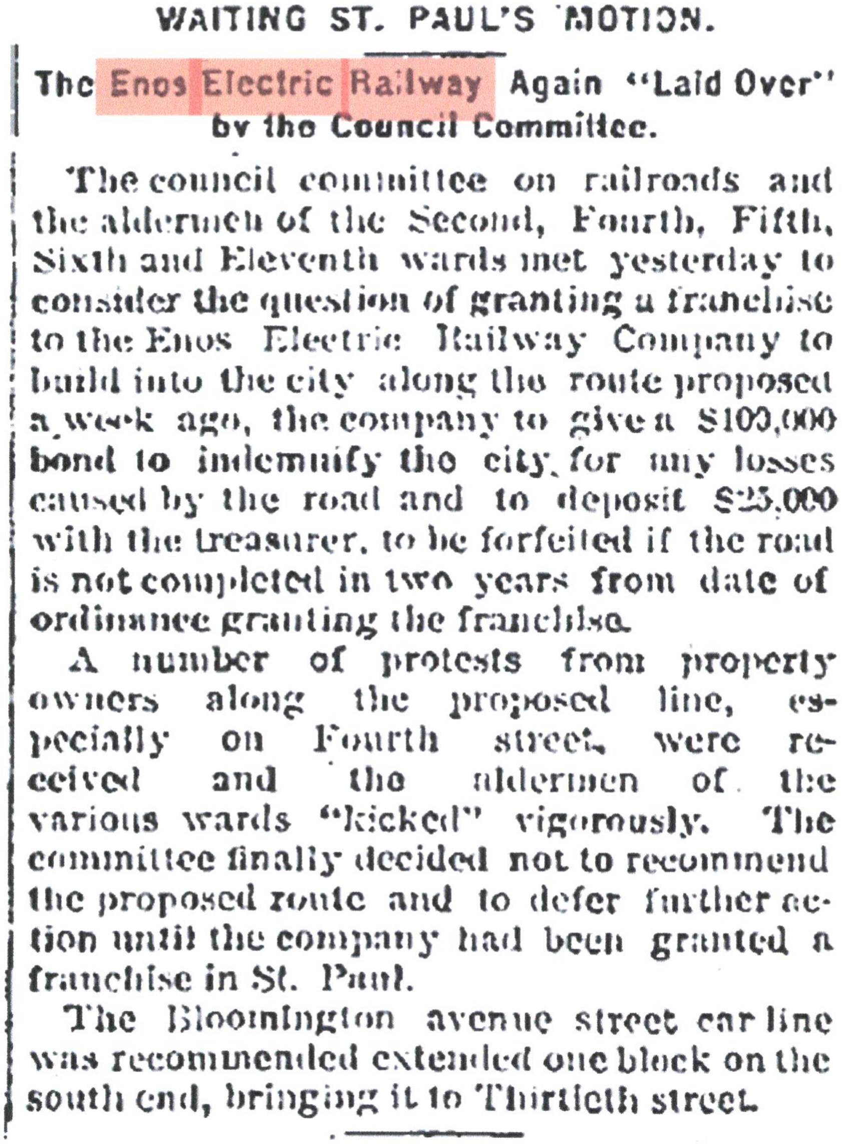
Thomas Cochrane was the first to enter the debate. He spoke in general terms of the benefits of rapid transit, and urged the possible sacrifice of the individual good for the public benefit. Gen. C. C. Andrews followed, submitting statistics showing how the New York elevated railway had benefited the city. Charles N. Bell opened up the opposition. He argued that there was no provision in the city charter for the granting of franchises to other than steam or horse railway companies; that the ordinance provided that the structures should be of the most approved style, but did not specify that the company should keep pace with the progress of electrical science; that the Enos electric railway was only an experiment, and finally, that the financial standing of the incorporators was not of the best, and that the money required would not be forthcoming. For 25 minutes Mr. Bell waxed warm in debate, but finally gave way to E. V. Smalley, who devoted himself to answering the arguments of the opposition. Mr. Smalley favored the ordinance because it would lift St. Paul out of the rut into which it had fallen, due to its great lack of rapid transit facilities.

"We may as well," said Mr. Smalley, "look the situation in the face: there is a lull in our prosperity, due to a lack of rapid transit facilities. Minneapolis has left us behind temporarily, because that city has provided superior interurban transit facilities, and has gained 25,000 people by its motor line."

J. H. Davidson spoke at some length in the same strain, and answered some of the legal technicalities of the case which had been touched upon by Mr. Bell. This closed the regular debate on the question, but the council granted a few minutes time to Mr. Gilman, of Boston, representing the Thompson-Houston Electric Railway, which is backing the Enos Electric Railway Company. Mr. Gilman maintained that the proposed railway is not an experiment. Omaha, New York, Boston, Pittsburgh and Richmond have electric railways, and Montgomery, Ala., has no other kind of street railways. So far as the financial responsibility of the backers is concerned, Mr. Gilman said that the Thompson-Houston Electric Company had already invested $25,000,000 in electric railways in this country, and its financial standing was known to all the commercial agencies.

The ordinance was then read a second time and several minor amendments were adopted. An amendment was presented providing that the company could do nothing until a sum sufficient to pay every claim of property holders had been deposited. Ald. Cullen spoke warmly in opposition to the amendment, saying that it would forever kill he franchise and keep St. Paul from having my fast transit facilities. The amendment was lost.

The ordinance was defeated, too, lacking the necessary two-thirds vote, 10 voted in favor of it and six against. It was then referred back to the committe on streets to be taken up again in August. Mr. Gilman in an interview said to a TRIBUNE reporter that the Thompson-Houston company would probably go to some other city to put in the electric railway. They had quite enough, he said, of the St. Paul councils, though he thought the people were in favor of granting the franchise.



WAITING ST. PAUL'S MOTION.

The Enos Electric Railway Again "Laid Over" by the Council Committee.

The council committee on railroads and the aldermen of the Second, Fourth, Fifth, Sixth and Eleventh wards met yesterday to consider the question of granting a franchise to the Enos Electric Railway Company to build into the city along the route proposed a week ago, the company to give a $100,000 bond to indemnify the city for any losses caused by the road and to deposit $25,000 with the treasurer, to be forfeited if the road is not completed in two years from date of ordinance granting the franchise.

A number of protests from property owners along the proposed line, especially on Fourth street, were received and the aldermen of the various wards "kicked" vigorously. The committee finally decided not to recommend the proposed route and to defer further action until the company had been granted a franchise in St. Paul.

The Bloomington avenue street car line was recommended extended one block on the south end, bringing it to Thirtieth street.

Mpls Tribune 7-17-1888

SOUTH St.PAUL RAPID TRANSIT CO.
Street Railway Journal articles

January 1888 directory: 8 miles, 40 & 56# rail, 10 cars, 4 electric motors to each car. Enos Electric Railway system with Daft motors. President A. R. Clark, secretary & general manager A. R. Lawrence. Office; German Bank Building.

June 1888: Enos Electric Railway experimental line was given a test on Wednesday, May 9th. The line contained many sharp curves and in places the grade amount to 6 1/2%. The test failed to develop any defects.

SAINT PAUL: THE ENOS ON TOP The St. Paul C
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ProQuest Historical Newspapers: Minneapolis Tribune (1867-192
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SAINT PAUL.

THE ENOS ON TOP.

The St. Paul Council Grants the Company the Right to Build.

The Conditions Are Many and the Line Must Be Open to the Public Within Two Years from the Passage.

The Participants in the Bass Lake Fight on Trial in the Municipal Court.

Judge Egan and F. F. Davis Act for the Prosecution and W. W. Erwin Defends —The Evidence.

An ordinance granting permission to the Enos Electric Railway Company to operate an elevated railroad in St. Paul, and to bridge the Mississippi river, was passed last evening at a special meeting of the St. Paul city council. The "L" ordinance, as originally put in, has undergone essential modifications, and the company is only granted the right to construct its lines in West St. Paul, and to bridge the Mississippi to Second street. The ordinance, under these changed conditions, met with no very decided opposition, and was passed by a vote of 13 to 3, Ald. Kavanagh being absent, and Aldermen Gehan, Melady and Sullivan voting against it. Mr. Bickel changed his vote.

The ordinance as passed, allows the company to build a railway from the intersection of South Robert street with the city limits to State street, thence to Greenwood avenue, thence to East Delos street, to Starkey street, to Cedar street, there to bridge the Mississippi and cross to Second street. The company is to secure the right of way by condemnation, purchase or other lawful manner; to provide suitable stations at convenient points along its line, and everything to be constructed of the best materials and in the most approved style.

The rates of fare to be charged must not exceed 5 cents for any distance between Annapolis and Second streets, and if the line is extended through the city of St. Paul to the city limits of Minneapolis the rates of fare shall not exceed 5 cents for any distance between Annapolis street and Lexington avenue, nor more than 15 cents between its terminals in the two cities.

The company must construct the line from Annapolis street to the Mississippi and make it ready for public use within two years from the acceptance of the ordinance.

The bridge across the Mississippi must be completed within three years. The company shall deposit in four months in the city treasury the sum of $25,000, and shall forfeit the same if the line is not built. The ordinance grants these privileges for 50 years, and may grant like franchises to other companies.

The company is to be held liable for damages which it may cause, and shall execute a bond for $50,000 for the payment of the same. After five years from the acceptance of the ordinance the company is to pay the city 1 per cent of its gross earnings. The ordinance must be accepted in four months.

A murmur of approval ran around the hall when the vote was declared. The company will doubtless accept the ordinance, which, while it is far from what they asked for at first, gives them a foothold, and if the trial line is successful the line will doubtless be extended to Minneapolis.

AINT PAUL.

RYING TO EXTEND.

ow that It Has the Inch, the Enos Electric Company Wants the Ell.

e Company Wants to Build Its Elevated Road out University Avenue to the City of Minneapolis.

When the city council met last evening, e friends of the Enos Electric Railway ompany were on hand and wanted the line xtended to the Minneapolis city limits. hey gracefully waived objection to laying e matter over to next meeting, when the d sores will be torn open and the fight will on as merrily as usual, with the odds in vor of the company.

The Enos Company had the floor a second me by offering an ordinance giving them e authority to build their elevated electric ilway from the end of their proposed ridge on Second street, along Cedar to ighth to Wabasha, to University avenue to e city limits. The company was promptly at upon by the council's referring the ordince to the committee on streets.

MPLS TRIBUNE 8-22-1888

1260 LF long

The Enos Elevated Electric Railway System.

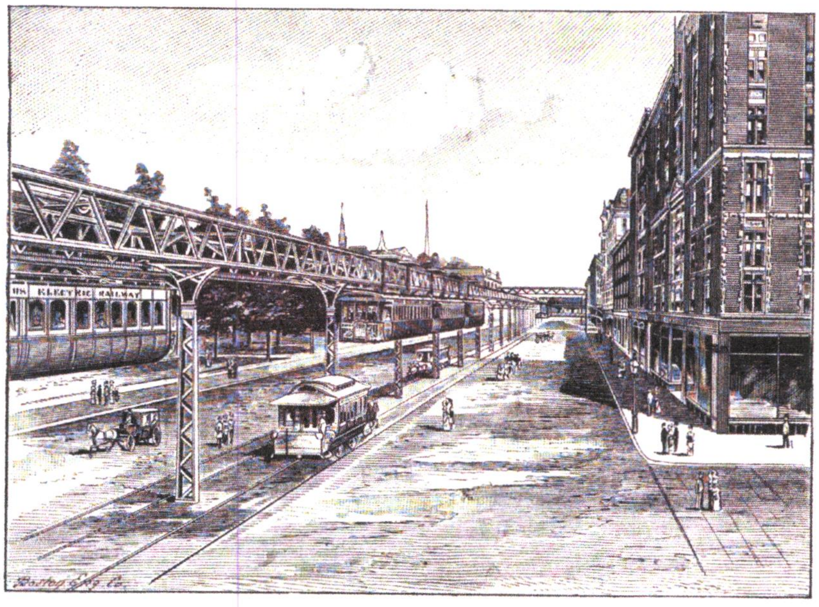
From time to time mention has been made in these columns of the Enos electric railway system, the peculiarity of which is that the running gear of the cars is placed overhead, the cars being suspended under the track, which consists simply of a single line of truss work. This system, invented by Mr. Enos, and now being introduced by the Enos Electric Railway Company, of Boston, was tried not long since at the works of the Daft Electric Light Company, Greenville, N. J., where a car operated by a Daft motor was run on a section of track. The system has been adopted for use at Los Angeles, Cal., and efforts are now being made to obtain permission for its use in Boston.

The accompanying illustration gives a fairly good idea of the method of constructing the line and suspending the cars. As here shown, the car is 14 feet above the ground, and therefore clears everything but exceptional obstacles. The truss is open and light, and there is necessarily an absence of wooden guard timber, cross-tie bars, sleepers, etc., which go to render the structure heavy and make the street below dark and gloomy. The current is carried to the motor by the rails, on the upper trestle, while the guide tracks or brake-wheels follow the under trestle. As will be observed, the whole electrical apparatus, being above everything else, is far beyond possible reach of the passengers or operatives, all that is required being the protection of the motor from the elements. The track shown in the cut is supported by a post similar to those now in use on the New York elevated roads, but all that is above it and on it is a strong lateral bracing and a light truss span. It is evident that with such a road, the cars as well as the track structure can be considerably diminished in weight; and it will also be clear that to derail a car would be an exceedingly difficult, if not impossible, thing to do.

Until the system is given a thoroughly practical test, it would not be fitting to pronounce very emphatically upon its merits. It may be said, however, that at Greenville, 1,000 feet of track, with a curve of 60 feet radius and a grade of 400 feet to the mile, was put in operation with a full sized car capable of carrying 60 passengers. We were among the passengers, and found the motion the easiest we have ever experienced in car riding.

At the general offices, No. 2 Pemberton Square, is the model room, in charge of Mr. Geo. A. Johnson, the electrician of the company. The room contains a very beautiful working model, one-fifth size street car, on the Enos system, for the inspection of any one that may desire to see it. It runs upon a circular track fifteen feet in diameter. The current is furnished from the Daft power station. The rails are used as the circuit, conductivity at joints being assured by established methods. The top rail is insulated by a proper device for that purpose. The lower rail is common with the whole structure. The current is taken up by driving wheels, thereby dispensing with all brushes or special pulleys for that purpose. Hangers are insulated midway, the upper parts of motor frame being charged from the top rail, the return contact being through the guide wheels or lower trucks. The attention of the visitor is called to the simplicity of the moving parts in all its detail. As Mr. Johnson expresses it, "There is no more mechanism in the hanger than to a barn door," and the device certainly seems simple, with its pulley shafts elongated on both ends, the armatures placed upon them, the pulleys keyed to the shaft, the four separate fields forming four independent motors (two on each shaft) that can be worked together, or separate, should an accident happen to one or more of them at any time. There is, in short, a direct application of power, doing away with all gears, belts, endless chains or other parts of that nature.

The model can be made to perform all the movements that would ever be required of a full-sized car. The car is also lighted by the current that moves it. Mr. Johnson has devised for use upon this railway an automatic crossing signal that will at all times announce the approach of trains at crossings or stations by ringing a bell by day, and in addition to said alarm showing an incandescent light at night. The system seems eminently adapted for overhead transit in cities with narrow streets.



METHOD OF SUSPENDING CARS FROM OVERHEAD TRACK, ENOS ELECTRIC RAILROAD SYSTEM.

The Telephone in New England.

The report is appended of the New England Telephone and Telegraph Company for the past year. The gross figures are as follows:

	1886.	1885.	Decrease.
Gross earnings	$919,109	$920,841	$1,781
Expenses	659,695	697,014	37,328
Net earnings	259,413	223,816	*35,596

* Increase.

Dividends of $210,000 were paid during the year. There was expended for construction, $37,819; for reconstruction, $39,440; for repairs, $147,734; a total of $224,734. The mileage of exchange wires Dec. 31 was 12,308, an increase of 643 miles. Other statistics show: Exchange subscribers, 13,007; express, 518; private line and agency contracts, 2,680; total of subscribers Dec. 31, 1886, 16,205; total of subscribers Dec. 31, 1885, 15,526; increase, 679; extra-territorial lines, 79; miles of extra-territorial pole lines, 2,109; miles of extra-territorial wire, 8,092; number of regular employés of all classes, 478. The estimated cost of extending and maintaining the plant in 1887 is $260,000. The surplus account Dec. 31, 1886, was $369,178. The balance sheet upon that day was:

DEBTOR.

Licenses	$4,268,000.00
Plant	6,126,511.84
Unissued stock	1,605,400.00
Trustees	231,000.00
Construction (for the year 1886)	37,819.49
Office furniture, teams and tools	15,851.90
Bells, Material and supplies	125,635.58
Accounts receivable	87,450.07
Cash	68,909.68
Total	$12,566,578.51

CREDITOR.

Capital stock	$12,000,000.00
Surplus account	369,178.42
Income account	101,913.75
Reserve accounts	64,373,59
Bills and accounts payable	31,112.75
Total	$12,566,578.51
Net gain of exchange subscribers for the year 1886	590
Net gain of agency subscribers for the year 1886	89

A dividend of 75 cents per share is payable May 16.

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Charging Secondary Batteries by Means of a Low Potential Magneto-Electrical Machine.*

BY F. J. SMITH.

It is sometimes inconvenient to set up a dynamo and engine of considerable size for charging secondary batteries. As the following method by which only a small machine and motor is used has answered well for several years, it may perhaps be of use to others who, like myself, are engaged in physical work. A small water motor drives a small magneto Gramme machine; the same motor by means of wheel work, for reducing velocity, switches the machine on to one cell of the battery at a time; such being the case, the E. M. F. of the charging machine need only be a little *in excess* of that of each cell. The method of charging in parallel was tried, but it did not answer well, as a slight difference of internal resistance of the cells caused the current to be unevenly distributed amongst them. A somewhat similar method of switching in cells by clock work has of late been introduced into the chlorine battery of Mr. Upward. The idea of putting the current on to one cell at a time seems to be due to Poggendorff (if I remember right), *Electrical Magazine* for 1842. It may be mentioned for the benefit of those who use chlorine gas, that it can be readily produced in abundance by the electrolysis of hydrochloric acid (carbon electrodes being used, as platinum is acted on by the gas as it comes off). A small motor and electric machine effects this constantly in the laboratory.

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*London *Electrical Review*.

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Winding Magnets.

To the Editor of The Electrical World:

Sir: Will you oblige an old reader of your valued paper by telling me the resistance of a wire $\frac{3.1416}{4}$ units long and one unit in diameter? It is used in the formula for filling a bobbin with wire of a given resistance. See "Monroe and Jamison's Pocket Book," p. 402, 3d ed.

$$d = -i + \sqrt{i^2 + \sqrt{\frac{K b (A^2 - a.)}{R}}}$$

A = outer diameter of the bobbin.
a = inner diameter of the bobbin.
b = its length.
d = diameter of wire to fill it and produce a certain given resistance R, allowance being made for the radial thickness i of the insulation of the wire. K is the resistance of a wire $\frac{\pi}{4}$ units in length and 1 unit in diameter.

Please explain this. Burton C. Wilson.
Charlotte, N. C.

Answer.—This formula is a general one for determining the diameter of the bare wire, which will completely fill the space allowed for the coil or windings of a magnet or solenoid, and at the same time have a certain given resistance when wound.

The value of K, which depends only on the quality of the wire, may be calculated once for all for coils of copper wire. It is the resistance of a short, thick piece of copper of the dimensions given. If inches are used as the unit of length, as they probably would be in your case, this wire is $\frac{\pi}{4} = .7854$ inch long and 1 inch in diameter. Its value may be calculated from the following convenient formula:

$$R = 10.065 \frac{L}{D^2},$$

in which R is the resistance in legal ohms at 65 degrees Fahr.; L is the length of a wire in feet, and D its diameter in mils or thousandths of an inch. The constant, 10.065 which may in most cases be changed to 10, is determined from Matthiessen's standard. From this the value of K, when the sizes are in inches, will be .00000659. Care should be taken, in using the formula that you give, that all the dimensions are in the same units, say inches. Also, that the thickness of the insulation i is not confounded with the increase of the diameter due to insulation, the latter evidently being $2i$; this thickness should also be given in the same unit as the other dimensions. The formula you give is a convenient one for finding the proper size of wire for winding dynamo magnets, as it is always known what the dimensions of the coil space are, and what the resistance of the magnets may be; this resistance should always be assumed smaller than what it actually may be, in order to allow for a factor of safety; this is especially important for shunt machines. A further calculation should always be made to see that the wire does not heat too much. We have checked the formula and it appears to be correct.—Eds. E. W.

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The Comforts of An "Apartment House."—"You must know that none of the occupants of this building are obliged to even send their letters out of doors for deposit in a lamp-post box," said the superintendent of a mastodonic apartment house recently. "There is a sluice in every room, the letters are dropped in, and as soon as there is a bit of an accumulation in the office we put it in the box at the corner, and that's all the trouble there is about it. Now," he continued, "what do you suppose that our next introduction is to be? Of course you can't guess. Well, we change a calendar in each suite every morning, regulate the clock by electricity, and, by Gemini, we are going to tell them how the wind blows by a little dial. There is a public weather dial, and it has been there for years, on the side of a building down in Burling slip. That will show you what I mean and pretty near how ours will be worked."—*New York Times.*

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The Electric Transmission of Power
by Robert Luce 1886

As the driving wheels can be of any diameter desired, it will be easy to fix on the size that shall give the speed desired on any particular road, with the best electric efficiency, without the necessity of using gearing.

It is estimated that each car loaded will weigh thirteen tons, or not more than forty tons to the train of three cars. An empty car of the Manhattan road weighs almost twelve tons, and with a load of eighty passengers it weighs nearly nineteen tons. The loaded train of the Riley system will weigh just half as much as a loaded train of the Manhattan road without its locomotive; it will have three cars where the Manhattan has four cars and a locomotive. Thus the saving in weight will be very considerable, and there will still be enough left for traction, as when the motor car is loaded there will be five tons concentrated on its driving wheels. In the locomotives of the Manhattan road fifteen tons are carried by the drivers, and so are effective for tractive power. If it is desired to have a larger weight for traction in the Riley system, it can be had either by loading the motor car with dead weight, or by using electro-magnets acting on the rails. Probably neither of these methods will ever have to be resorted to; but even if they should be found necessary, the weight for straining and wearing out the supporting structure will never be so great as in the present New York elevated system.

A minor advantage of the Riley system, yet one that should not be overlooked, is the fact that a perfect footwalk for truck walker is provided, as well as a way of escape from passing trains. This makes track inspections easy and safe.

The Enos System.

John A. Enos, of Peabody, Mass., has very ingeniously combined in one system many of the merits of surface and elevated roads, at the same time doing away with the most obnoxious features of each. His idea is to suspend the cars, — not a wholly novel idea, but one that has never before been so carefully worked out. Previous inventors have generally aimed at suspending panniers or

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very small cars from elevated rails; but Mr. Enos has gone far beyond this, and intends to suspend large passenger cars at any height that may be wished, either so that their bodies will be as near the ground as those of ordinary street cars, or so that they will be as high as the structure of the ordinary elevated road. Thus the road may have all the advantages of a surface road, without the disadvantages of surface rails and horses; or it may be like an elevated road, with a saving of some of the steps and a great deal of the cumbersome structure so obnoxious in all elevated systems now in operation.

In this system a single line of posts will support by means of brackets at right angles to the road a lattice girder four feet in height. This structure is so open and light that it will not darken the street, obstruct the view, or present any serious objection whatever to property-owners. On the top of the girder runs the carrying rail; on the bottom, the steadying rail. Each car has four wheels, two running above the upper rail and two below the lower rail. With the framework connecting them, they form a sort of truck from which the car hangs. One upper and one lower wheel will be over the front half of the car, and the two others will be over the back half. The framework suspending the car is so supplied with springs that it can sway enough to prevent undue strains in starting, going round curves, and stopping. The flanges on the upper and lower wheels make it absolutely impossible for the car to jump the track. Thus the car is freed from the law which governs ordinary railway systems, viz., the greater the speed, the greater the weight necessary to keep the car on the track; it follows that the rolling stock of the Enos system can be very light. As every car is equipped with a motor, every passenger adds to the weight available for traction, and there is no need of heavy rolling stock for this purpose. With the very light cars and the single rail, curve resistance is reduced to a minimum. With all these advantages, it is thought that the speed could easily be run up to a hundred miles an hour, if it should be wished.

The motor is placed on the truck above the girder. Its arrangement was devised by Mr. Enos, and has won the

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hearty commendation of Leo Daft. It consists of four field magnets, one on either side of the two driving wheels. The shaft of each driving wheel is prolonged to form the armatures, so that really there are four armatures. Any or all of these field magnets can be thrown in or out of the circuit at will, so that one can do all the work, or two, or more, just as the man in charge of the car pleases. By means of a simple switch, reversing can be accomplished almost instantaneously with no hurt to the machine; full speed is secured with wonderful quickness. There is very little jar or jerk in starting or stopping the car.

One beauty of this system is the almost perfect method of conduction furnished by the upper and lower rails. They are out of harm's way, can be easily insulated, and can do neither man nor beast any injury. No extra rail is needed, as is the case on the New York elevated roads.

Perhaps electrically the most important feature of this system is the very small driving wheel used. It has been pointed out that the greatest difficulty electric railways have to surmount is the necessity of gearing between the motor and the driving wheels. As the smaller the driving wheel the more its revolutions to propel a car a given distance in a given time, the difficulty is greatly lessened by reducing the diameter of the driving wheels. In the cars now being made for the Enos system the driving wheels are but six inches in diameter, and it is perfectly practicable to use four-inch wheels. With a four-inch wheel the car would move a foot at each revolution. As dynamos can easily be made that shall do economical work at six hundred revolutions a minute, it is easy to see that using no gearing at all the Enos cars can maintain a speed of six hundred feet a minute, or about seven miles an hour, and do it with the most economical efficiency in the electric transmission. Of course, the size of the driving wheels can be increased as much as desired, or the speed of the motor can be increased. Using either means, or both together, any amount of speed can be made possible.

In this system there is no gearing to waste power. As the wheels are few, the loss from friction is reduced to a minimum. The simplicity of the whole structure makes

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its first cost light and the running expense small. The owners of the system believe a road can be built and equipped for much less than $15,000 a mile, and many horse-car roads have cost as much as that. Mr. Enos estimates that one of his cars can be run with a maximum speed of ten miles an hour with the average number of stops and starts, for a dollar a day of sixteen hours.

Another advantage claimed for this system by its inventor is, that as he especially devised it for the use of electricity as the motive-power, and no other, it is naturally better adapted for that purpose. The motor, too, was especially devised for this system. As the cars are small and light, and as each has its motor, only such sizes of motors will be required as have been in constant use for a long time. Small motors are almost as nearly perfect as they ever will be, and so there is no need of experimenting with them.

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